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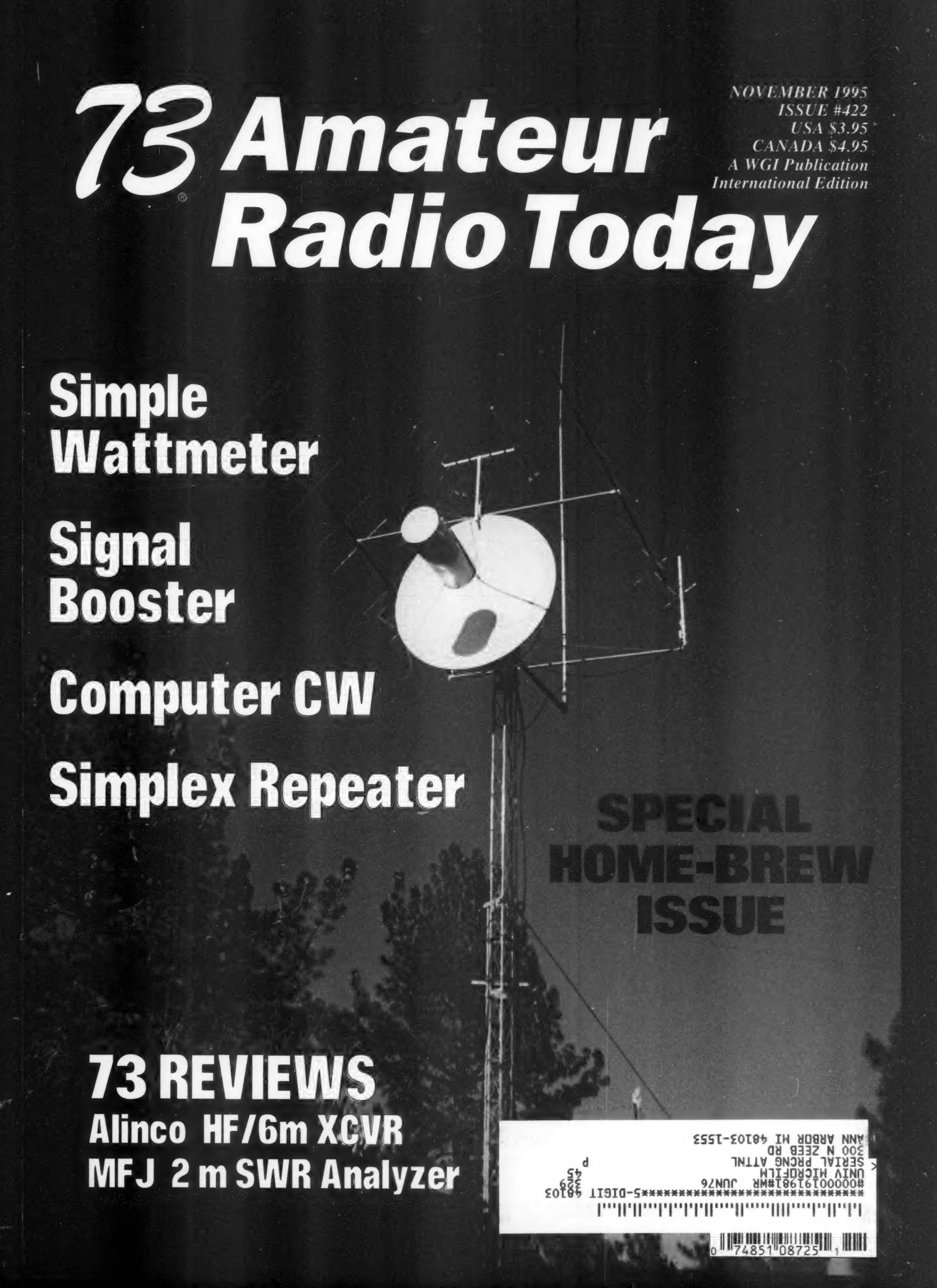

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73 REVIEWS

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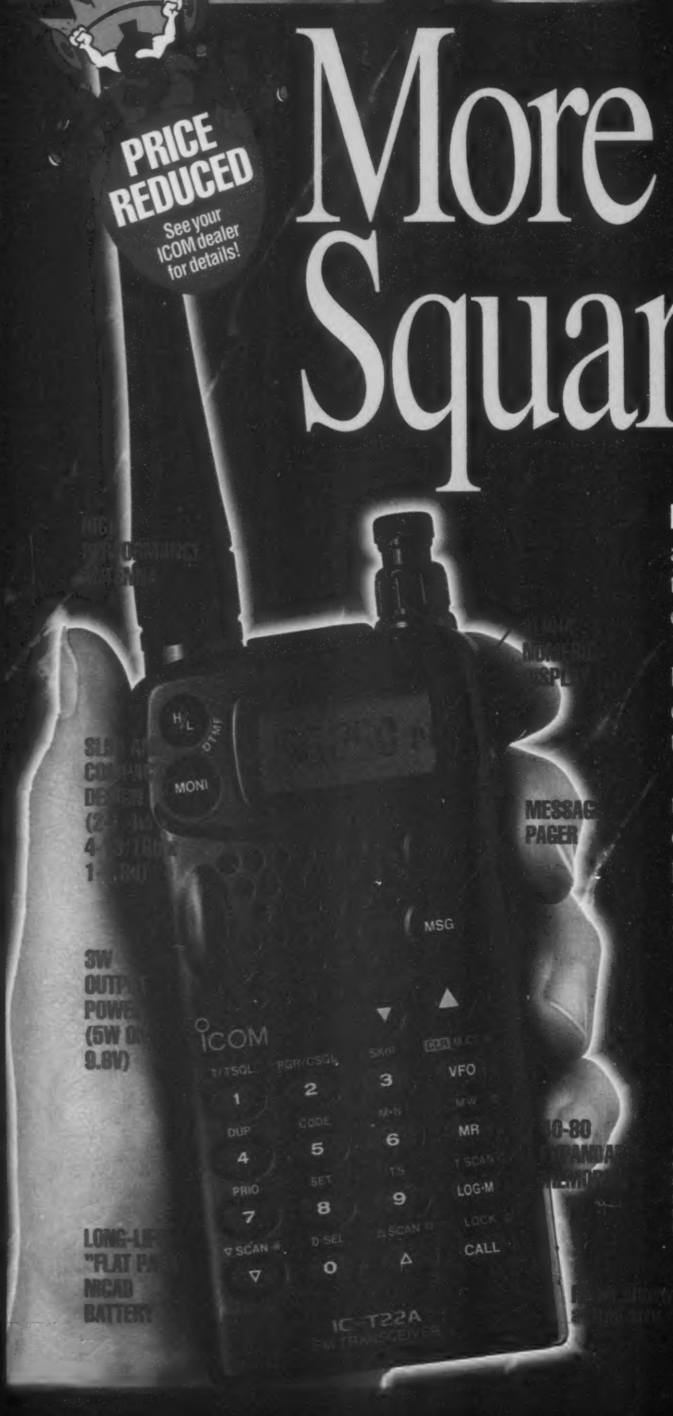
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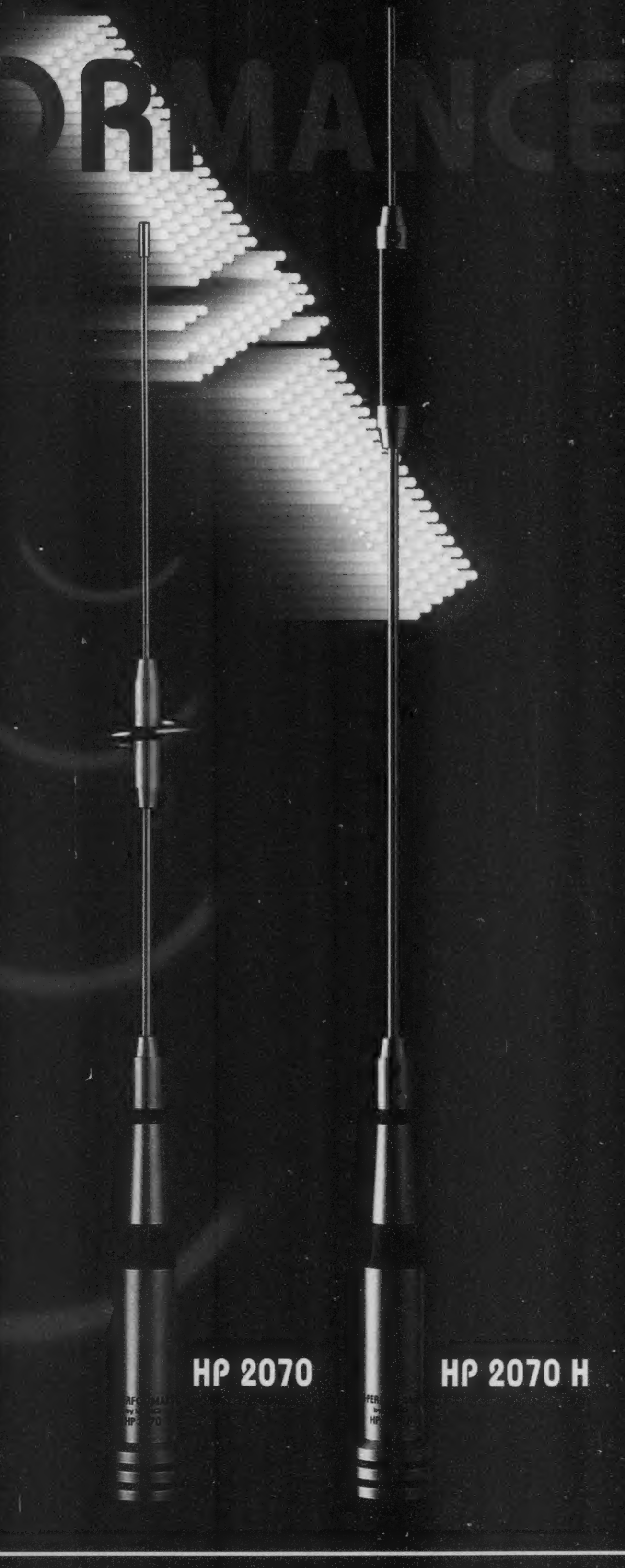

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....WB6NOA

Toby Metz KB7UIM's life as a fifteen-year-old is anything but drab. Look on page 16 to find out why he's learning sign language from his teacher Mary.

FEEDBACK... FEEDBACK!

It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK list on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best.

On the cover: "I'm the person who built it, but I couldn't have raised it without good friends." Cover photo by Mike Snowden KE6HVH, who thanks Norm Larson KN6JE, Mike Zeman KE6CNO, and Ed Ginsberg KE6BNL, for helping to raise this tower, dish, and quagis at a field-day campsite. See relating story on page 10.

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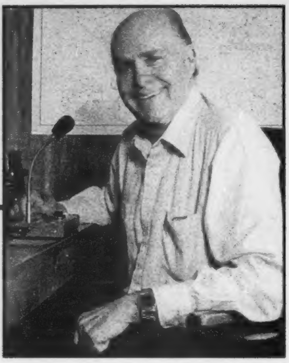

Hey, That's Bribery!

Yep, that's about the size of it. I'm going to bribe you into (1) writing letters I can't refuse to print because they are so interesting or entertaining, (2) or you've sent me some news clipping that forces me to write some editorial, (3) or you've sent in a combo subscription for *73* and *Radio Fun* for your local library or a school library, or (4) in some other way significantly contribute to making my day a happy one (like sending me a good article, complete with a disk and photos).

You see, I'm also in the business of making compact discs for a zillion small record companies. One of the ways I've been helping them promote their music is to have our music experts listen to these CDs and rate each selection. The top-rated track from each CD is then put on a sampler CD, along with other music of the same type to help people discover, as I have, that almost all of the really creative music these days is coming from these small, independent record companies. So, in case I decide you've "made my day" with something you've submitted, let me know what kind of music you like the most. Your choices are: (a) jazz, (b) pop/rock, (c) contemporary instrumental, (d) classical, (e) world, (f) folk, (g) blues, (h) country/bluegrass, (i) Christmas, (j) music for kids, (k) gospel, (l) big band, (m) new age, (n) Cajun, (o) cargo, (p) soft rock, (q) Scottish, (r) reggae, (s) pianists, (t) fiddlers and pickers, (u) love songs, (v) perfect 10/10s, (w) Doctor Dream, (x) Qualiton Sampler, (y) Koch Sampler, (z) Secret Guide Hodgepodge. That ought to hold you! Each CD has around 15 top-rated selections, and I've got most of the CDs from which these tracks were taken available at bargain prices for hams. You'd ordinarily have to pay $15 or so for top-notch music like this and I'm *giving* it away . . . if you help to make my day.

What can you write about? If you haven't built anything interesting, can't review a new product, and haven't gone on a DXpedition, then maybe you could write about the most exciting time you've had with amateur radio? Like, did I tell you about the time I made a raft of moonbounce contacts through the big dish at Arecibo on 1296 MHz? Now, that was exciting!

Better Use?

In case you've been wondering what's become of the 220–222 MHz segment of our 220 band which the FCC confiscated because (1) we weren't using it enough, (2) we don't have an even half-way effective lobby to protect our hobby, (3) our hobby is almost unknown to the public, and (4) we don't have enough hams to register as even a faint blip with congress, our old band is alive and well and being put to some very good uses. For instance, they've been developing a new generation of digital radios for business to help cut the cost of cellular phones. They provide both voice and data channels and have been busy erecting towers for the repeaters in several areas of the country. In Florida, for instance, each tower covers a 40-mile circle and can handle a thousand customers. This has cut the costs of communications for some users from around $2,000 a month for cellular telephones to $25 a month for the new service. (Thanks W2NGN/4 for the newspaper clippings!)

Contest

Last year I mentioned that the Albert Einstein College of Medicine had discovered that when a small current was passed through the blood it prevented the HIV virus from acting and replicating. Little has been published in the medical literature since then. Does this mean that this approach has failed? Or rather that it has been successful?

The so-called health care industry is driven by the pharmaceutical companies, which seem to have firm control over the AMA, the FDA, federal research dollars, and Congress. When a new disease comes along, that means more potential profits from new drugs. Whee! So one of the last things the whole industry wants to see is an inexpensive cure for a serious illness. Or any illness.

Is it possible that something as simple as passing about 50 microamperes through the blood can end AIDS and HIV? And perhaps other blood miseries such as herpes? If you've been reading much about the FDA you know that they've let hundreds of thousands of people die by preventing the American sale of drugs that have been saving lives in other countries. There's a lot to be said for the concept of not trusting the government. I know that in my dealings I have had that concept constantly reinforced.

A physicist I know (Beck) came up with an ultrasimple approach to passing current through the blood without having to remove it from the body first. Since all of the blood circulates through the major arteries, why not hook a couple of electrodes to the body and let the current go through the blood while it is circulating? The blood has the lowest resistance, so most of the current flowing through the body will be going through the blood.

And since you don't want to mess with the body's electrical signals controlling the heart, it's best not to have the current passing through that organ. Why take chances? So instead of passing the current from arm to arm, the electrodes can be put on the ankles so the current passes through the leg arteries. No harm has come of this in thousands of trials.

We published a chart in *Radio Fun* showing the body's resistance. From that it's simple to calculate how much voltage to apply to get a net of 50 microamps. It comes to around 36 volts, which can be supplied with four 9-volt transistor radio batteries. It seems to help to keep reversing the current, which can be done with a miniature double-pole relay and a small timing circuit.

Beck found that, by using the "blood purifier" about 20 minutes a day, in a few weeks the T-cells rebuilt their strength and the HIV virus disappeared. Several hundred people have used the gadget so far and I have yet to hear of a failure to eliminate HIV. Beck believes that this should also work on the ebola virus. Considering the fatality rate for the virus, there seems little to lose in trying this approach.

Since the AIDS virus tends to hide away in the lymph glands, often for years, Bob figured that a strong magnetic field might shake it loose into the blood stream, where the purifier could then do its work. He wound a coil of wire and put it in series with an old photo-flash unit, thus inexpensively providing the zap of current for the coil. Copies of *Gray's Anatomy* are available from discount book sellers to help people find the location of the lymph glands.

So here's a challenge for you gadgeteers. Let's see what you can come up with in a simple circuit which will allow people to pass about 50 microamps through the body, switching the polarity two to ten times a second. Let's use a flip-flop instead of a relay and LEDs to indicate correct and low battery voltage. And don't forget a potentiometer to vary to voltage. Keep it simple.

Beck has been giving talks on this approach to medical groups, trying to re-educate them away from the normal drug or surgery approach to medicine. That's a tough sell.

In order to make sure that the blood purifier was safe, Beck first tried it out on himself. Instead of 20-minute sessions, he left it on for a couple of hours, as I've mentioned in a past editorial. He found that, as a result, he was losing weight. He kept on losing until he reached a normal weight for his build and then the weight loss stopped. He doesn't know just why this worked, and it's too soon to be sure of what it will do for others. But if it does replace dieting, someone can make billions! Well, they can, if they can stay one step ahead of the FDA. Or two steps.

Continued on page 74

NOT SURE WHICH RADIO TO BUY? HERE'S WHAT THE EXPERTS HAVE TO SAY ABOUT AZDEN.

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(73 8/94) ..."its handheld PTT microphone has a solid feel and produces solid transmit audio. Its receive audio is full, loud and undistorted, and sounds better than many mobile rigs. And the rig is beautiful... maybe the only game in town for a moderately priced 6-meter FM rig." ***(Radio Fun 10/94)*** ..."The Azden PCS 7500H exceeds my performance expectations! It's a real bargain in today's ham equipment marketplace and every 7500H owner I've talked to agrees with me!"

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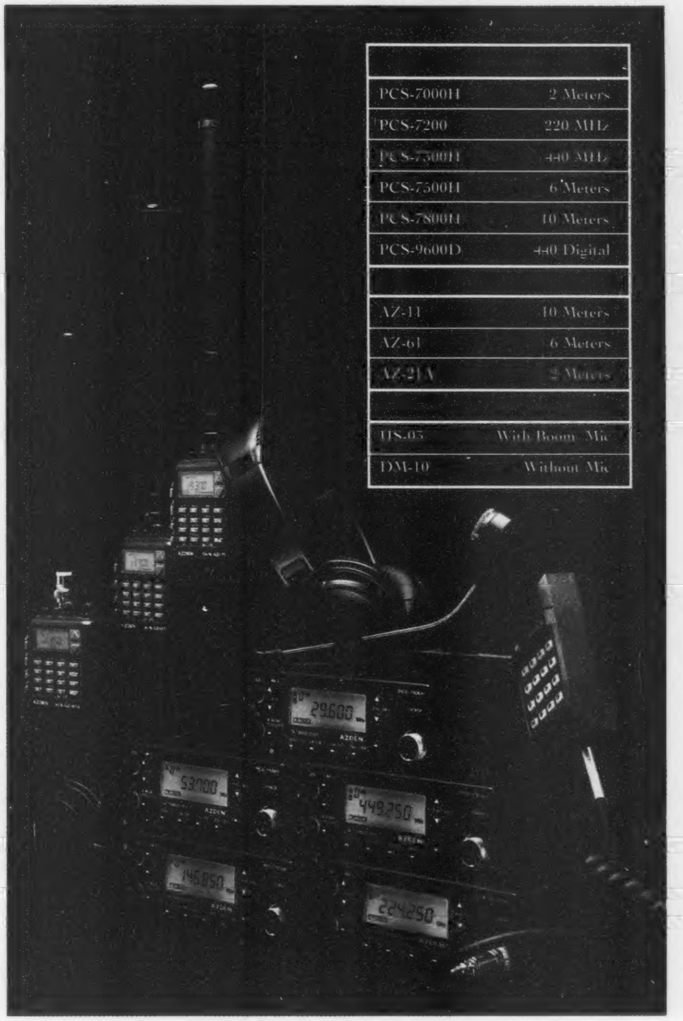

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PCS-7200	220 MHz
PCS-7300H	440 MHz
PCS-7500H	6 Meters
PCS-7800H	10 Meters
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LETTERS

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From the Ham Shack

Jim Fonte KK9T Did you know that the ARRL called for a meeting of Frequency Coordinators in St. Charles, Missouri? To be invited you had to be a recognized Frequency Coordinating Entity. Pay attention to that word, recognized! This meeting was the opportunity, according to the ARRL, (and now also chiming in, the Mid-America Coordination Council, a.k.a. MACC) for the frequency coordination community to finally develop a way to get FCC acknowledgment and recognition of themselves, develop the concept of Single-Point-Of-Contact frequency coordination, put teeth into the enforcement of repeater coordination by re-instating repeater licenses, and set up a plan of national coordination standards from which all Coordinators would administer repeater frequency coordinations and band-planning.

What concern is all of this to you anyway? Well . . . read on. Oh, excuse me . . . please pardon my bad manners and allow me to introduce myself. Jim Fonte is the name. KK9T is the call. I am the Coordinator of the Indiana Repeater Council Technical Committee. Been licensed for 26 years, active on 160 meters through 23 centimeters, so I am relatively confident of what I write with regards to amateur radio repeaters.

The following story is true . . . none of the names have been changed to protect anyone!

On July 8, 1995, I was asked by one of our Indiana Frequency Coordinators if I would be interested in attending a National Coordinators Meeting in St. Charles, MO, in October. I said, "Sure . . . what's the agenda?" Well, this fellow wasn't completely certain, as he had only heard about it recently. He gave me a phone number for Lisa at the ARRL HQ, telling me to call to make my reservations for the hotel, and find out what I could about the meeting. When I finally got through to Lisa on the 25th of July, I asked her to fax the hotel info and any other stuff she had on the meeting. She said she would get the hotel info out right away, though she couldn't help me with the meeting information, but "would I like to speak to Jay for that meeting agenda?" She connected me to Jay Mabey NU0X, the guy who edits the ARRL Repeater Directory. I introduced myself and asked him what the reason was for this gathering. He said that it was an opportunity for the frequency coordinating community to get together to hammer out the process of gaining recognition from the FCC, work out all those problems that are plaguing Frequency Coordinators everywhere, and a chance to discuss the coordination of the 219 to 220 MHz band through the newly proposed Single-Point-Of-Contact System (SPOC) of frequency coordination that the FCC is insisting on. He said that this was the Frequency Coordinators' meeting, to be orchestrated in whatever manner they deemed necessary. When I asked him what the agenda was, he said he didn't know because they hadn't written it yet. They, *who? "We* haven't," he answered. I said, "I thought you said that it was the coordinators' meeting?" He answered, "It is!" I said, "Well, if it's the coordinators' meeting, don't you folks think that the coordinators should be setting the agenda?" He answered, "Yes, they will be asked what they want to do at this meeting, and then *we* will set up the agenda." Whoa! Let me get my bearings here! I gathered from this much of the conversation that the ARRL had probably been the catalyst for this entire sequence of events, and that I should probably ask a few more questions before drawing any premature conclusions.

I asked Jay about this supposed database for the 219 to 220 MHz band, the one the FCC supposedly wants for administration by this SPOC. Jay said, "It's already compiled . . . I did it." I asked him who authorized him to do that. He replied, "The ARRL Board of Directors." I asked him, "Who the hell authorized them to authorize you to do that?" He said he didn't know. I proceeded to tell him of my displeasure in discovering that this whole situation seems to be nothing more than a trumped-up bunch of non-issues, for the purpose of creating the illusion that the ARRL is recognizing a "real problem" and setting out to fix it! I also asked why all of these apparently earlier private meetings or discussions between the ARRL and the FCC were not reported to the general ham population in *QST*. He said he didn't know. Jay gave me an E-mail address of a fellow in Texas who is responsible for "remailing" information concerning frequency coordination. He also said that he would fax additional information to me about the St. Charles meeting, and that it was his hope that I would see that the ARRL is "not trying to pull a fast one," as "everyone" seems to think . . . that they are only trying to help out the frequency coordination community!

Well, its the 9th of August, and I still haven't received that hotel information or that other stuff that Jay promised to send. And I don't really expect to, either! I can tell you that the ARRL is apparently after something (what now?), again by organizing a meeting, the subject of which is *no business* of the League's . . . except maybe $$$ and their Repeater Directory. Frequency coordinators from all over the country have no choice now but to get involved, and try to reign in this situation before the League causes any further damage to processes that aren't broken and don't need to be fixed.

Remember, in the beginning of this article . . . I asked you to pay attention to the word "recognized?" Here's why. The latest version of the FCC Part 97 Rules and Regulations, Part 97.3a(20) defines what it (the FCC) thinks a Frequency Coordinator is and what it should do. Is that *not* recognition? What more recognition do we need? Do we have to have more numbers and letters attached to our call signs before we are convinced we are recognized officially? Part 97.201c defines an auxiliary station concerned with harmful interference . . . a reference is made to the Frequency Coordinator. Part 97.205c defines a repeater station concerned with harmful interference, and again, a mention of the Frequency Coordinator's role in this self-policing hobby of ours. But wait . . . there is that phrase, *self-policing*. In the old Rules & Regs there used to be a mention of ham radio being self-policing, etc. Well, I can't find that phrase anywhere in the *new* Regs, but I remember it being stated in the definition of amateur radio when I first got into the hobby. And the words and meanings stuck with me! Even if the FCC no longer absolutely, positively states that self-policing tenet, why not try to live up to that concept anyway?

Part 97.101 refers to General (Operating) Standards. Subpart (a) states, "In all respects not specifically covered by FCC Rules, each amateur station must be operated in accordance with good engineering and good amateur practice." I can read and understand this . . . why can't the ARRL? Subpart (d) states, "No amateur operator shall willfully or maliciously interfere with or cause interference to any radio communication or signal." What is so hard about that concept? Let me say it right now, loudly and clearly. I have the utmost praise for the American Radio Relay League, its technical accomplishments and publications, but geeezz, you guys need a hobby! I didn't think you folks were in business to help the FCC add more rules and regulations, and more layers of useless, stifling bureaucracy to our amateur radio hobby, but it sure seems like you're trying!

Your actions (you, the ARRL Board of Directors) are doing much to disenfranchise your membership and any others who might be thinking of aligning with you. As a very simple analogy, when was the last time you called your Congressman or State or Local Representative and said, "I don't think I'm paying enough taxes, could you see what you can do to raise them?" Or asked, "When are you going to add some more laws defining what I can do with my front lawn landscaping?" No, I'm not being ridiculous! The last thing we need to do is pester the FCC with mundane frequency coordination enforcement matters and other things that we should and can handle by ourselves! OK, I hear the gentleman in the rear with the raised fist (at me!) saying that he just can't solve *this* problem through normal means . . . he has to get the FCC involved. Fine, so be it! But just don't go whining to the FCC saying that you need to be anointed, somehow, with more power over those renegade ham operators! If you do, it's only going to be a matter of time before the FCC has had enough. "Let the auction begin! How much are we bid for this four

Continued on page 84

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On-Line Ham Rag

There's a new ham online magazine on the World Wide Web. Check it out at evengraph@aol.com. They're looking for articles, letters, and so on. *TNX Amateur Radio Newsline.*

FCC Downsizes

The Federal Communications Commission may downsize and close its monitoring stations. This could have a serious impact on Amateur Radio, as we hear from Paul Courson WA3VJB in Washington:

The FCC may automate all nine of its monitoring stations across the country and run them by remote control from its facility near Washington. And personnel layoffs proposed by FCC Commissioner Reed Hunt would be another side affect of budget cutting in Congress. Hunt told the *Washington Post* that he sees a mandate to make the agency smaller. Hunt would fire 180 workers under the plan and close a dozen regional and field offices by this time next year.

If the downsizing is carried out, it would be the largest payroll reduction in the 51-year history of the FCC. But Hunt says even if the cuts in fact are carried out they might not last. He said telecommunications rules are changing and more people will eventually be needed to oversee those changes. As many as 80 additional responsibilities could come from the Telecom Legislation recently passed by the House and Senate. The bill has yet to become law. At the same time, the House has proposed freezing the commission's budget for next year. No word yet what the Senate might do.

But Hunt is acting on a worst-case scenario in the meantime. He would close nine of 25 local field offices resolving interference complaints. He would also close half the regional field offices of the FCC, cutting Atlanta, Boston, and Seattle from the six the agency now has. As for the monitoring stations, the Commissioner believes all nine can be operated remotely by the agencies main tracking facility at Gilford, Maryland, about 15 miles outside of Washington.

Hunt would preserve the enforcement workforce, while cutting jobs in public affairs and administration. The FCC in recent years has shied away from initial direct action on complaints in the amateur service, instead directing reports to a volunteer core charged with building a case. It's not yet clear whether the FCC might distance further from many intervention disputes on the ham bands, leaving it up to hams themselves to settle things or put up with problems.

Again, Chairman Hunt is talking about a worst-case scenario. Only time will tell how far the downsizing will have to go. *TNX Newsline.*

Oklahoma Hams Praised

Ham radio has received words of praise for its part in relief efforts following last spring's terrorist bombing of the federal building in Oklahoma City. Oklahoma Senator Don Nickles has entered into the Congressional Record a tribute to volunteers who helped in the aftermath of the April bombing of the Murrah Federal Building in Oklahoma City, including amateur radio operators.

In his remarks, Nickles cites an outpouring of love, selfless effort, and resources. He says that the community is indebted to those volunteers who created a silver lining to the dark cloud of the tragedy.

Specifically Nickles says that amateur radio operators provided an essential service to rescue operations. Within minutes of the attack, operators were on the scene providing an emergency communication network that allowed for the organization of supplies as well as firemen, policemen, and rescue crews from countless communities.

Their contribution of 360 hours of service, Nickles was says was made possible by donations from electronics companies such as the Oklahoma Community Communications Center. *TNX Newsline.*

Family Consecutive Calls

When couples get their licenses together it's not unusual for them to get consecutive call signs. Kathy and Don Falls of Charleton MI did. She got KB8ZZZ and he got KC8AAA. Would you like to compute the odds on that one? They're active on 2m and looking forward to upgrading to the HF bands. *TNX Amateur Radio Newsline.*

Alien Search Mounted

Now that congress has ended all NASA's SETI funding, the SETI League, Inc., hopes to involve five thousand radio amateurs in Project Argus, a renewed search for signs of extraterrestrial intelligence, which kicks off on Earth Day, April 21, 1996. If you're interested in participating in this scouring of the heavens for stray radio signals, call 800-TAU-SETI.

Cornell's thousand-foot dish at Arecibo used computers for several years, searching the skies unsuccessfully for any coherent signals. Perhaps thousands of smaller ears can do what a few very big ears have failed to do.

Recent changes to Morse Code policy in New Zealand upsets ARRL old timers

In New Zealand the Ministry of Commerce is responsible for radio policies and administering the radio regulations on behalf of Government. The Ministry recently announced a new Morse Code policy which included the following statements:

"At the present time (the International Telecommunications Union rule) RR 2735 effectively requires all administrations to verify a competence in Morse Code before the issue of an amateur license to operate in the frequency bands below 30 MHz. The Ministry has now considered this provision quite carefully and has concluded that it is no longer appropriate as a Treaty obligation for Government.

"The licensing provisions of RR 2736 provide that 'Administrations shall take such measures as they judge necessary to verify the operational and technical qualifications of any person wishing to operate the apparatus of an amateur station.' There is clearly ample scope under this regulation for an administration to require competency in Morse or not as deemed appropriate. RR 2735 adds a specific obligation in regard to Morse Code, and in so doing limits national freedom but without providing any greater benefits.

"The Ministry has therefore formed a view that it is appropriate to propose the deletion of RR 2735 at the forthcoming WRC-95 and will now work to this end. Part of this work includes, as is usual, the prior discussion of draft proposals with other administrations and this will be undertaken in the first instance in conjunction with the Conference Preparatory Meeting in Geneva next week. As such discussions continue over the next few months the Ministry will refine any New Zealand proposals prior to the formal agreement by Government of the delegation brief."

YHOTY '95

A 15-year old from Alton IL has been honored as the 1995 Newsline Young Ham of the Year. Adam Weyhaupt N9MEZ received the honors August 19th at the recent Huntsville Hamfest Banquet.

Adam was chosen for his many contributions to the community through the use of amateur radio. During the midwest floods for 1993, Adam, who was thirteen at the time, was in charge of scheduling hams for round the clock emergency communications. He also handled net control duties for a local disaster net.

The following year, Adam served as a key communications organizer for the fifteen-day U.S. Olympic Festival in St. Louis. And if that is not enough, Adam acts as a net manager for a local emergency service net. He is active in the local Skywarn Network and edits a regional Skywarn newsletter.

"Ham radio is certainly a unique hobby. It is one of the few hobbies where you can have a good time and yet help so many people. And while you should certainly have a good time, I strongly encourage all of you to use your communications talents to help other people in whatever you can do. Because that is what ham radio is really about.

"Whatever you decide to do, just jump in with both feet and do the best job that you can do. And people will remember you, because you have done such a good job and you will be helping many people."—Adam Weyhaupt N9MEZ

The Newsline Young Ham of the Year Award is sponsored jointly by *Newsline,* Yaesu USA and *CQ Magazine. TNX Newsline.*

A Plug for *Newsline*

We at *73* wish to express our gratitude to *Amateur Radio Newsline* for providing late-breaking news to the ham community. Audio reports can be heard over the phone at the following numbers: Los Angeles: (213) 462-0008; Los Angeles (Instant Update Line): (805) 296-2407; Seattle: (206) 368-3969; Seattle: (206) 281-8455; Tacoma: (206) 927-7373; Louisville: (502) 894-8559; Dayton: (513) 275-9991; Chicago: (708) 289-0423; New York City: (718) 284-0752; Melbourne, FL: (407) 768-7447; Houston: (713) 362-4650. Check with your local amateur radio club to see if *Newsline* can be heard weekly on the air in your area. Digital copy is available from many online services and Internet sites. For more information, contact Dale Cary WD0AKO (Internet E-mail: wd0ako @rrnet.com) or look into the rec.radio.info newsgroup.

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CIRCLE 159 ON READER SERVICE CARD

Home-Brew Quagis

A novice can build these 2m and 440-MHz antennas for under $15.

by Mike Snowden KE6HVH

I remember, as I was growing up, being awakened at zero dark hundred hours by the unbelievable roar (what I now know as intermod) of garbled voices coming from the speakers of my J. C. Penney stereo, which I had left on while I had fallen asleep. It was my father, now silent key K6YPB, attempting some DX work with his old Swan rig. Aside from the early morning cardiac test, I also remember that he always seemed to be building something. The name Heathkit was so common around the house, I often wondered where this mysterious sibling was hiding.

Now after some 37 years, I was bitten the ham radio bug. While my father would build rigs, I was just plopping down my plastic. It was not long till I began to get the urge to try some building of my own. I do not have the electronics background that my father had, and with Heathkit being out of the kit-building business (as of a few months ago, they still provide product support on some of the kits), there did not seem to be much left.

"Home-brew," as I began to learn, seemed to be a lost art form in my area. I joined a local ham club, but discovered that there were no club building events or projects. So I picked up a few books from the local ham store and began to read. My interest was soon drawn to the subject of antennas. There is an overabundance of information published on the subject and it seemed a good place to begin a foundation. Besides, these parts did not appear expensive, especially when mistakes, I mean, design changes, are made.

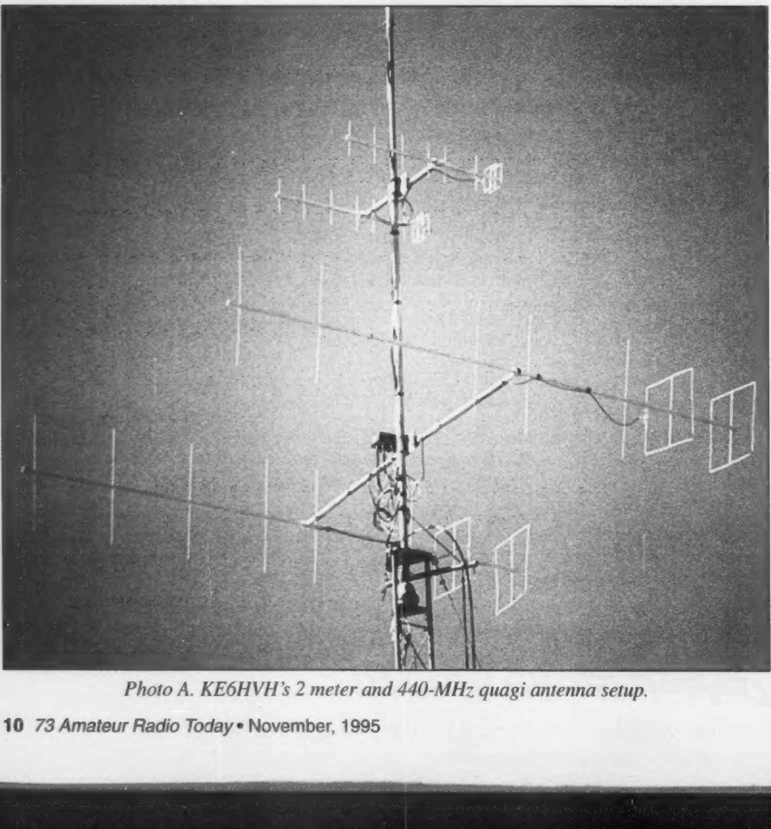
Photo A. KE6HVH's 2 meter and 440-MHz quagi antenna setup.

One of the books I found most helpful was the *ARRL Antenna Book.* It was stuffed full of designs and projects. Being a "newbie" I opted to start with VHF/UHF projects. This month's cover photograph depicts a few of my first efforts in antenna building. Even the tower was a "home-brew" project. The first two antennas were 2 meter and 440-MHz quagis. Then a 6-foot, 1.2-GHz dish, and then a second 6-foot dish tuned for 440 MHz. All designs and information were taken from the pages of the *ARRL Antenna Book.* Some design changes were made to reflect better SWR and gain. In the case of the quagis, all parts are available from most hardware or hobby stores. The 440-MHz quagi parts will cost between $12 and $15. The parts for the dish antennas might be a bit more difficult to find. I had the dishes left over from upgrading home satellite systems. They may be purchased new from most satellite dealers.

Just What *Is* a Quagi?

The quagi is a cross between a quad and a yagi antenna. The reflector and the driven element represent the quad and the director elements are that of the standard yagi. The book boasts a 13-dBi gain. In my experiments I found the quagis to be very directional with nulls developing 10 degrees off either side when vertically oriented. Cross polarization rejection is very good also, with significant drop off starting at 45 de-

MFJ *Dual Band* Mobile Antenna

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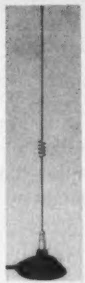

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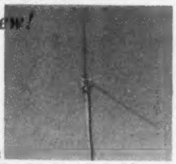
You get 15 feet of coax with a standard PL-259 coax connector for your mobile rig.

You get a BNC adapter so you can also use it with your handheld!

Your MFJ-1724B is protected by MFJ's famous one year *No Matter What*™ unconditional guarantee.

DualBand144/440 MHz Ground Plane

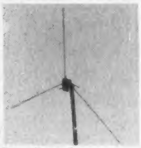
MFJ-1754 *New!*
$24.95



Dual band ground plane antenna for 2 Meters and 440 MHz gives you extra long range on 440 MHz with a high gain halfwave over quarter wave radiator. On 2 Meters you get solid quarter wave performance. Mounts on 1 to 1½ inch mast with single U-bolt. Easy-to-tune.

1/4 Wave Ground Plane

MFJ-1740
$12.95



The MFJ-1740 brings up 2 Meter repeaters as well as any ¼ wave ground plane made!

You get easy tuning, low loss ceramic antenna insulator and strong lightweight aluminum construction.

Single U-bolt mounting for 1 to 1½ inch mast. Cutting chart included for 220/440 MHz. Made in USA.

MFJ Pocket Roll-Up™

2 Meter halfwave J-pole antenna

MFJ-1730
$14.95

Roll up this *halfwave* 2M J-pole antenna and stick it in your pocket! It's the perfect *gain* antenna for traveling.

Get home station performance on the go. Just hang your *MFJ Pocket Roll-Up*™ in the clear and plug the BNC connector into your handheld.

It's omni-directional and has significant gain over a ¼ wave. It does not need a cumbersome ground plane so it's convenient for indoors and works great with handhelds. Made in USA

Dual Band *flexible* Ducks

144/440 MHz flexible ducks for HTs

A. ***High Gain FlexiDuck***™, **MFJ-1717, $19.95**. Enjoy dependable QSOs when other rubber ducks give you noise. High gain ½ wave on 440 MHz, full size ¼ wave on 2M. Won't jab you -- bends, twists, flexes with you. 15¾ inches.

B. ***FlexiDuck***™, **MFJ-1716, $16.95.** Similar to MFJ-1717. Full ¼ wave on 440 MHz, efficient loaded ¼ wave on 2 Meters. 8¾ inches.

Shorty Duck™ for HTs

MFJ-1718
$12.95

Add this *short*, 4¼ inch *ShortyDuck*™ to your 2M handheld for a Q-5 signal! Impedance matched for maximum gain. High-Q helical wound radiator.

5/8 Wave 2 Meter Mobile Antenna

MFJ-1728B
$24.95

For *maximum range* while mobile, use MFJ's ***Maximum Gain***™ 5/8 Wave 2 Meter Mobile Antenna. You'll get the maximum possible gain of any single element mobile antenna!

Competitive 5/8 wave mobile antennas can't work any better -- no matter how much more they cost.

You get low SWR so your rig can safely deliver maximum power into your antenna. It's rated at 300 watts PEP so you can use any mobile rig plus a mobile amplifier.

You get a heavy-duty magnet mount that holds your antenna tight at highway speeds and a black magnet base that'll look good for years.

You get a stainless steel radiator that'll endure years of harsh mobile use and 12 feet of coax cable.

You get MFJ's one year *No Matter What*™ unconditional guarantee.

Order MFJ-1728B with standard PL-259 coax connector and also includes a *free* BNC adapter for your handheld.

Glass Mount *Dual Band* 2 Meter/440 MHz

MFJ-1734
$39.95
New!

The MFJ-1734 is the *best* glass mount dual band 144/440 MHz antenna in ham radio!

It's perfect for your dual band mobile. A free BNC adapter is included for your handheld.

You'll get a potent 2.6 dB of gain on 2 Meters and a thundering 6.3 dB on 440 MHz with low SWR. It handles 50 watts of power and includes 12 feet of coax, cleaning pad, and all mounting hardware.

A small 6 inch counterpoise mounted inside your vehicle lowers SWR and makes tuning easy. Tuning tool included.

A unique radiator mount lets you adjust the outside radiator for angled surfaces -- no tool needed. The radiator is easily removable to prevent damage to your antenna when you wash your vehicle.

It's easy to install on a glass window or other non-conductive surface.

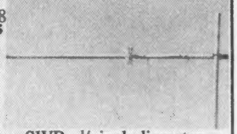
MFJ-1738, $29.95, for 2 Meter, less counterpoise.

MFJ-94, $7.95, remounting kit for MFJ-1734 and MFJ-1738.

MFJ dual band 144/440 MHz Yagi

7 elements on 440 MHz . . . 4 elements on 2 Meters . . .$69.95

MFJ-1768
$69.95
New!



Get *two* Yagis for the price of one . . . put two Yagis in the space of one with *single* coax feed! Gets 7 elements on 440 MHz and 4 elements on 2 Meters.

MFJ's *exclusive* dual band balanced feed with *FerriteChoke*™ decoupling prevents pattern skewing and gives you low SWR. ¼ inch diameter driver elements give wide bandwidth.

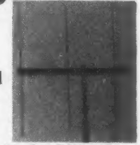
This *National Bureau of Standards* design is optimized for maximum gain, high front-to-back ratio and clean symmetrical pattern.

Mounts vertically for FM/Packet or horizontally for SSB with single included U-bolt on 1 to 1½ inch mast or tower leg.

High strength 6061-T6 aluminum 5 foot, 1⅛ inch diameter boom. 2 pounds. Elements are electrically isolated from boom. Made in USA.

Portable 3 element Yagi for 2 M

MFJ-1763
$39.95



You can set up or take down MFJ's *portable* 3 elements 2 Meter Yagi in seconds! Elements simply screw into the boom.

You can take it with you wherever you go and have the "oomph" and directivity of a beam.

It's easy to store and sturdy enough to use as your home station antenna.

Mounts vertically for FM/packet or horizontally for SSB. *Center* or *end* mounts with single U-bolt. Great for packet/PacketCluster™.

It's compact 2¾ foot boom gives you a calculated gain within 1 dB of a four element Yagi with a boom nearly twice as long.

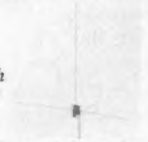
Extra thick elements maintain high gain and directivity over entire 2 Meter band. MFJ's *FerriteChoke*™ decouples feedline.

Elements and boom are made from strong lightweight aluminum and protected by MFJ's *Permanent Molecular Bonding Technology*™.

Weighs just 2 pounds. Boom is 30½ inches. Made in USA.

5/8 Wave Ground Plane

MFJ-1750
$19.95



For a low, low $19.95, you get a *high performance* 2 Meter 5/8 wave ground plane home station antenna -- you'll get the maximum gain of any single element antenna.

More expensive 5/8 wave ground planes can't work any better -- no matter how much they cost.

You get . . . shunt fed matching that bleeds off unwanted static and gives you low SWR . . . strong lightweight aluminum construction . . . low loss ceramic antenna insulator . . . MFJ's *RapidTune*™ radiator . . . MFJ's one year *No Matter What*™ guarantee. It mounts on 1 to 1½ inch mast with single U-bolt and is Made in USA.

MFJ-1752, $19.95, for 220 MHz .

HT Range Extenders

Telescoping antennas for handhelds

A. *Long Ranger*™ 2 Meter Halfwave, **MFJ-1714**, $16.95. For really long range this MFJ endfed halfwave is hard to beat. It outperforms a ⅝ wave on a handheld because the ⅝ wave needs a ground plane. The MFJ halfwave doesn't. It's shorter, lighter, has more gain and places less stress on your antenna connector than a ⅝ wave antenna. When collapsed, it performs like a rubber duck. 40" extended, 10½" collapsed.

B. *Dual Bander*™ for 2 Meters and 440 MHz, **MFJ-1712**, $14.95. Got a new dual band handheld or separate units? One antenna fits all. It's a ¼ wave for 2 Meters and a ⅝ wave with gain for 440 MHz. 7¼" collapsed, 19" extended.

C. ***Pocket Linear***™ ⅜ Wave, 2 Meters, **MFJ-1710, $9.95.** Carry this pen size antenna in your pocket like a ballpoint pen. When you're using your rubber duck, on the fringe and noisy, put on the *Pocket Linear*™, extend it to 24½" and carry on your QSO. Has pocket clip. 5¼" collapsed.

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grees when being rotated from vertical to horizontal. These experiments were conducted on a number of antennas built at a club building party, and the results were very consistent. In less than an afternoon, either, if not both, the 2 meter or the 440-MHz quagis can be built. The dish is a weekend project, as it requires much more effort to build. The tower is a major project requiring special skills and experience and should only be attempted by those who posses the welding and fabricating skills to complete a project of this nature safely.

For this article, we will concentrate on the building of the quagis and leave the dish antenna to a follow-up article. The following is a short list of parts and supplies that will be needed. With the exception of the boom for the 2 meter quagi, try not to vary from the described parts, as it can have an effect on the resonant frequency and SWR.

Construction

Construction of the two quagis is the same. Only the dimensions change. I will describe the building of the 2 meter quagis, but the techniques apply to both. We start by cutting the director elements. Do not use a wire cutter or other such cutting tool. Use a hobby razor saw or hacksaw. Cut the six director elements to length, starting at 35-5/16 inches and ending with 34-3/8 inches, in 3/16-inch steps. Be sure to identify each element with a marking pen to designate which element it is. For example, the first element may have one line and the sixth will have six lines. Next cut one piece of 3/8-inch wood dowel to 21 inches and another to 21-3/4 inches long. Notch a "U" shape groove in the end of each dowel, parallel to each other. The notch in the ends will hold the wire loops in place. Now cut the #6 bare solid copper wire to 85 inches long. Measure and make three marks on the wire at intervals of 20-1/4 inches. We are now going to form the reflector square loop. Grip the #6 wire with a pair of pliers so that the first mark is on the edge of the pliers' jaws. Starting with the shorter end of the wire, fold it up to a 90 degree angle, creating the first side of the loop. Now grip the wire at the second mark. While keeping the first leg of the loop pointing straight up, start to fold the wire upwards to form the second leg of the loop. Now do the same with the third mark. When done you should have a square loop with sides of approximately 20-1/4 inches (inside to inside). With a hammer, flatten the two meeting ends slightly, so that the flattened sides are parallel to each other. The flattened side will provide more surface area for a stronger solder joint. Solder the flattened joint together. This completes the reflector loop. Now cut the 10-gauge insulated copper wire to 82-1/4 inches. Strip about 3/4 of an inch of insulation from both ends. Solder the 10-32 solder lug onto one of the ends. Starting at the same end that the lug is on, measure and place a mark on the wire at 10-7/8 inches. Now, from the 10-7/8-inch mark, measure 20-9/16 inches and mark the wire. Measure and make two addition marks on the wire at 20-9/16-inch spacing. You should end up with 9-11/16 inches remaining. Using the same technique as used for the reflector, bend the 10-gauge wire into a square using the marks you put on the wire. Using the 4-40 nut and bolt, fasten a corner of the SO-239 connector to the soldering lug which you attached to the 10-gauge wire. Set both of the loops aside and now we will work on the boom.

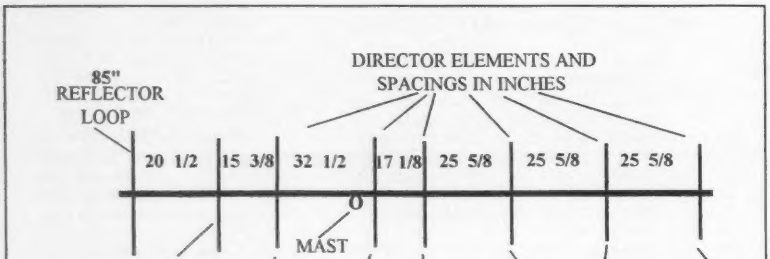
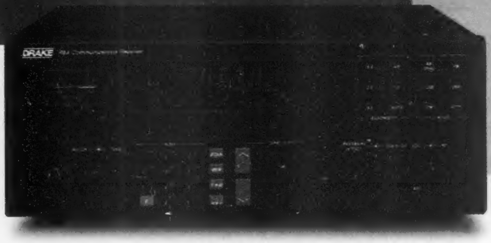


Figure. a) The spacing and element dimensions are somewhat critical. Pay close attention to your measurements. The elements are cut from 1/8" brass rod. Drill the holes in the boom parallel to each other. The elements are held in place with the silicone adhesive.

b) Orient loops with dowels vertical. Cut two wooden dowels 21-3/4" and 21" long. Notch the ends of the dowels in a "U" shape to support the top and bottom of the loops. Be careful not to distort the shape of the loop!. Attach coax to connector at a right angle and run coax back to mast.

Cut the boom material to 14 feet. Measure and place a mark one inch from one of the ends. Now drill a 1/8-inch hole through the boom, being sure that you are centered on the material and that you drill straight down. Now find a small piece of wood approximately 3/4-inch thick, 3 inches wide and 18 inches long. Using a 1-5/8 inch drywall screw, fasten the end of the boom with the 1/8-inch hole in it to the wood near the center. This will prevent the round boom from twisting as you drill the remaining holes. We are now ready to measure and mark the location of the holes for the director elements and the loop supports. Using a tape measure, starting from the end screwed to the wood, measure and place a mark at the "2-inch indication." Now pay close attention to this step so you do not end up with a boom that resembles

OUT OF THIN AIR AND INTO THE THICK OF THINGS.



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Swiss cheese. *For all the following dimensions, you will be adding **two inches to all** the dimensions called for in the drawing.* Stretch your tape measure across the top of the boom. Take a piece of electrical tape and wrap it around the boom and measuring tape near the starting end to hold the tape measure in place. After taping, be sure the 2-inch mark on the tape measure matches the 2-inch mark you made on the boom. If all lines up we are ready to begin marking the locations of the elements. Referring to the drawing, the first spacing is 20-1/2 inches. Remembering to add the two inches to the 20-1/2 inches, place a mark on the boom at the 22-1/2-inch indicator. Continue this same technique for all remaining element spacing. Remember to add the two inches to the given dimension. When done, double-check your measurements. You are now ready to dig out the Binford super drill you ordered from Tool Time. Place the boom on a flat surface such as the floor of your garage. Use a small block of 3/4-inch thick wood under the boom as a spacer. Starting at the *opposite end,* where the drywall screw is holding the boom, position the wood spacer under the first mark on the boom, drill a 1/8-inch hole through the boom. Try to keep the drill centered on the boom and take care to drill your hole perpendicular to the boom. Repeat this same step for the next five marks. When done, you should have six holes in the boom. Measure the diameter of your boom, divide the diameter in half. Now working from the end of the boom which is screwed to the wood, use that half-diameter dimension and draw a line through the center of the boom parallel to the wood. This line will be the reference line when you rotate the boom to drill the last two holes. Remove the drywall screw and rotate the boom 90 degrees so that the reference line is straight up and down. Either drill a new 1/8-inch hole one inch from the end and refasten the boom to the wood or, while carefully holding the boom in place, drill the remaining two 1/8-inch holes at the locations you had marked. Again take care to keep the drill perpendicular to the boom. Now change to a 3/8-inch drill bit, and drill out the two holes you just drilled to the new 3/8-inch diameter. These two holes will be for the wood dowels. We are now ready to assemble the antenna. For the assembly, you might want to suspend the boom in the air by hanging it from the rafters in the garage or some similar method. Starting with the shortest director element (either the one marked as "six" or as "one," depending on the numbering system you used), insert it through the first 1/8-inch hole in the boom at the opposite end where the drywall screw was. Center the element on the boom by being sure you have equal amounts sticking out on both sides of the boom. Continue to insert the elements in ascending order. When you are done with the director elements, insert the wood dowels in the boom. The 21-3/4-inch dowel goes in the first hole (closest to where the drywall screw was) and the 21-inch dowel goes into the second hole. Be sure to orient the notch in the dowel so that it will support the loops properly. Next, after checking to be sure all the elements and the wood dowels centered in the boom, use a drop of "super glue" to hold them in place. Now install the reflector loop on the first wood dowel. Center the loop on the dowel and glue in place. Install the driven loop as shown in the cut away drawing, so that the SO-239 connector is to the left of the wood dowel, when looking at the antenna front the rear. Push the SO-239 connector against the dowel and glue in place. Center the opposite side of the loop on the dowel and glue in place. With the exception of soldering the free end of the driven loop to the center conductor of the SO-239, the construction is complete and we are ready to move on to tuning the antenna. The driven loop was cut to a center frequency of 145 MHz. Depending on your needs, you can raise the center frequency by trimming the free end of the loop. (I suggest that if you do trim the loop, do it in small steps of about 1/16 of inch at a time, soldering the end to the center conductor and checking the SWR each time.) Solder the free end of the loop to the center conductor of the SO-239.

> ***"Note, if you use a radio to tune the antenna, use the lowest power setting possible to prevent causing interference to another operator."***

Parts List
2 Meter Quagi

14' 1-1/8" i.d. Fiberglas tube or 1-1/4" pvc pipe
18' 1/8" dia solid brass rod or six 3' pieces
6' 3/8" dia wood dowel
8' #6 bare solid copper—bare wire
8 feet 10-gauge solid copper—insulated house wire
1 SO-239 chassis mount coax Connector
1 10-32 nut and bolt
1 10-32 solder lug
1 tube silicone sealer

Parts List
440 MHz Quagi

5' 1" dia PVC pipe
6' 1/8" dia solid brass rod
14-3/8" dia wood dowel
3' 10-gauge solid copper—insulated house wire
3' 12-gauge solid copper—insulated house wire
1 10-32 nut and bolt
1 10-32 solder lug
1 SO-239 chassis mount connector
1 tube silicone sealer

Tuning the Antenna

There are two simple methods to tune the antenna. The first is to use your radio tuned to your desired frequency, using a SWR meter to tune for the best SWR at that frequency. The second method is to use an antenna analyzer. I use the MFJ model 259 SWR Antenna Analyzer. If you have any desire at all to build and experiment with HF or VHF antennas, this is a must-have item. Simply hook up the analyzer up to the antenna, turn the "tuning" knob to the target frequency on the digital read out, and read the SWR and resistance. Trim the antenna if necessary, resolder and that's it. This analyzer is also great for finding the resonant frequency of those hamfest/swap meet specials.

Note, if you use a radio to tune the antenna, use the lowest power setting possible to prevent causing interference to another operator.

When you are done tuning the antenna, be sure the solder joint at the SO-239 connector is a strong one. Use generous amounts of the silicone sealer to glue all the elements and dowels in place where they intersect with the boom. Also, put some silicone sealant on the ends of the wood dowels where the loop go through the notch. Now seal the back side of the SO-239 connector with silicone. Give plenty of time for the silicone to dry, and that's it. Mount the antenna and enjoy. The antenna works extremely well in either polarization. I cut the top off a PVC "TEE," found the balance point of the antenna and used two hose clamps to clamp the two halves of the "TEE" around the boom. I also chose to use a short length of PVC connected to the "TEE" as the a mast. Using the PVC as a mast eliminates any changes to the performance of the antennas.

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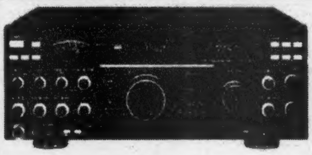
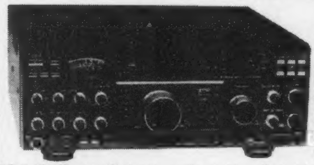


FT-1000MP

The New Yaesu FT-1000MP features ***Enhanced Digital Signal Processing (EDSP - a new multifaceted filtering technology unmatched in the Amateur Radio Industry).*** It also features dual in-band receive with separate S-meters, Collins 455kHz/2.75 kHz SSB mechanical filter buit-in and an optional Collins 455kHz /500hz CW mechanical filter. It also has a built-in electronic keyer, 100 watts of power, automatic antenna tuner, "Shuttle-Jog" enhanced tuning system, **transverter jack for VHF/UHF operation**, selectable antenna jacks, Cat System capability with built-in RS-232C Level Convertor, Wide receiver dynamic range, with separate, Optimized FET RF Preamplifiers for the High and Low bands, quick memory bandk system for instant recall of important memory channels, two VFO knobs for dual in-band receive, lighweight switch-mode AC power supply built-in, New High-Resolution DDS Tuning (Synthesizer steps as small as 0.625hz, Selectable cascaded Crystal and Mechanical Filtering, Independent 2nd & 3rd IF Filter Selection, Custom Feature Configuration via Menu SYSTEM. **CALL TODAY AND ORDER YOURS!**



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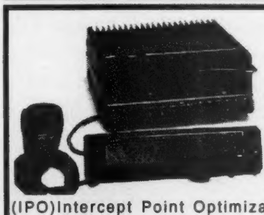

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FT-990

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A Boy Scout's "Drab" Life

Teaching in a unique second language.

by Toby Metz KB7UIM

Not long ago, I received a letter from Mr. "Never Say Die" (Wayne Green), editor of the very magazine in your hot little hands. He wanted me to tell you about what's going on in my drab little life. I mean, I'm a 15-year-old and my life by its very definition must be drab, right?

Mr. Green wanted me to tell you about some things that I am doing now. Understanding what's happening now with me means I first must give a short bio. Although I didn't know it at the time, this whole thing started when I was a mere child of 8. You see, I've been a Scout since the second grade, and I guess that's when "it" really began. Not too much happened in my otherwise routine first four years of Scouting. I did the usual mundane things like camping, whitewater rafting, snow- and water-skiing, rappelling, exploring caves, climbing rocks, and hiking. However, about 2-1/2 years ago, at the tender age of 12, during a routine and seemingly uneventful Boy Scout meeting, a new Scout leader appeared, promising us mirth and merriment on the air waves. All we had to do was get our Technician Class licenses. But that's not quite all I did.

Since that evening, opportunities that I never imagined possible have opened up for me. First, I received my amateur radio license at the age of 12. As a Technician Plus license holder I did lots of things, including some of that mirth stuff. For openers, I was the control operator for the only SAREX ever to have come to Idaho. Talking to Col. Bolden on STS-60 was a kick! I soon upgraded to General Class and was a participant during the 1994 Dayton Hamvention Youth Forum. I'm currently the Net Manager for the Discovery Net, a youth 2 meter net that tries to get and keep young operators involved in amateur radio and their community, and am a member of our local RACES/ARES net.

Last year I called the Discovery Net in front of 600 Scouts camping in the middle of the largest set of sand dunes in Idaho during the 1994 Jamboree-On-The-Air. Yep, I was K2BSA/7. That was really kind of neat, too, because I helped organize and introduce three distinguished guest speakers for the net. The speakers included Astronaut Dr. Tony England, the Lieutenant Governor for the State, and the Chief Scout Executive for the United States. We also linked Russian amateur radio operators through a phone patch from the Boise sister city, Chita, Russia. How we did all that linking so that everyone could hear and see was a trick all by itself, and worth a future article. So much for the historical stuff.

Mr. NSD wanted me to mention a little about my latest venture. As a Life Scout in the Boy Scouts of America, I really want to be an Eagle Scout. Since I needed a Service Project, I decided I might be able to make a difference in the lives of a few people if I linked ham radio with scouting. My Eagle Scout Service Project teaches deaf children and adults what they need to know to get their no-code Technician amateur radio license. With the license and some donated equipment, I've led a group of people to assemble and repair parts that put the deaf people on 2 meter packet.

This project was a challenge right from the start. I had three major problems. The first was finding students willing to put up with me long enough to get their license. The second was obtaining the equipment; and the third was to get the students to pass! Students

Continued on page 18

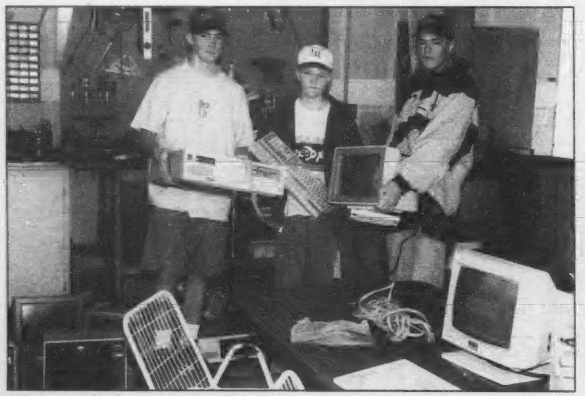

Photo A. Left to right: Jake, Travis, and the author prepare to fix computers.

Photo B. The author receives sign-language instruction from his teacher Mary.

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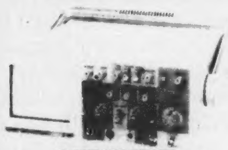
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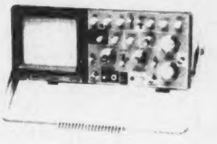
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CIRCLE 184 ON READER SERVICE CARD

A Boy Scout's "Drab" Life

Continued from page 16

were easy to recruit. There is a school for the deaf and blind in Idaho, and through some contacts with them I found two candidates. A third deaf student joined us after he found out what I was doing.

Finding and getting the equipment turned out to be more challenging than I had originally thought. As a gentleman of 14 when I started this project, I didn't have any money. Even at 15, I don't have money, but I learned the fine art of scrounging, whining, and begging. Through a friend I learned that the City of Boise had scrapped a bunch of computers and radios. After sending letters to a City Councilman and the City Purchasing Director, and finally sending a resolution to the Mayor and Council, I had my "day in court" and presented my request to the entire council. After they had unanimously approved it, I gained possession of six well-used computers and six even more-used fire truck radios.

Naturally, to get on packet, one needs to have a TNC. Again, being penniless, I asked Tigertronics for the availability and price of their TNCs, and then the Voice of Idaho Radio Club if they would pay for them. Happily, they both said "yes." The VOI also said they would spring for the crystals for the radios. Through a money-raising project (yes, I had to get a job), I earned enough to obtain the rest of the things needed to complete the project, such as power supply parts and antenna pieces.

The next job was to put it all together. Amateurs Dave Marquart WA7QKD and Rich Dees AA7WG helped me and a few members of Boy Scout Troop 1 recycle and repair the computers and radios. The radios were not too difficult to convert. Dave did the work in his ham shack. When the crystals arrived, tune-up was a snap. Rich and the Troop built antennas and power supplies. I used a simple ground plane antenna and a really cheap and simple power supply shown in the January 1981 *73*.

Teaching was different. First, I had to learn to teach. As a kid whose life is school and homework, you'd think I would know how to teach. I've had plenty of good, bad, and really bad examples. I also had to learn to communicate in sign language. I also found I had to write out lots of words. Big terms, like "heterodyne," "oscillator," and even "Ohm's Law," are not to be found in sign language. I also found that the younger students had a difficult time reading text in the study manual. If you want to get a feel for what it's like for them, read something a young deaf person has written and you'll find they leave out words and turn phrases around. I had to remember that they work hard just to communicate, and even harder to learn the FCC Rules and how a radio works. Some of those rules appear to be written in babble anyway. Finally, I had to take it slow. If the usual time for a Novice class is 8 weeks, quadruple it when communications is not smooth. In the end, I learned to teach and talk in a different language.

> ***"Well, the students hung in there. I struggled along and lots of people helped. The results are . . . success! "***

Well, the students hung in there. I struggled along and lots of people helped. The results are . . . success! So far one person, Bill Blohm KC7JSD, passed his no-code Technician and is now working toward his General. Although the equipment and lessons were for those who are deaf, I picked up three other people my age who are also working on their licenses and are scheduled to test soon. I'm presently teaching code to Bill and his son Hans (who can hear). Two other deaf students (10 and 13 years old, respectively) are working their way toward completion of their no-code Tech. With luck, at least one of them will be testing very soon.

As I mentioned, I have received lots of support for my project, including an autographed picture and a personal note from Heather Whitestone, the current Miss America. My girlfriend has seen both. All I could say (in response to the surprised look on her face) was, "What, are you jealous? Come on, it's just Miss America!"

Some folks think it would be a good idea to keep the project going. I'd like to do that, too, but it's going to take much more equipment and support. The organization, called the VOI Education Committee, is in place, but a source for the equipment is not. Well, such insignificant things haven't stopped me yet. I'll just put my 15-year-old mind to work and see what pops out. I must say it was really great to see Bill pass his test, and it's even more fun to see Peter (the 10-year-old) start to talk to me as we build things and work on his no-code Tech. If you want to get in touch with me, I'll tell you how the lessons went in detail and what I had to learn that may be different for hearing-impaired students. Perhaps with enough interest, we can make a difference in the lives of lots of people.

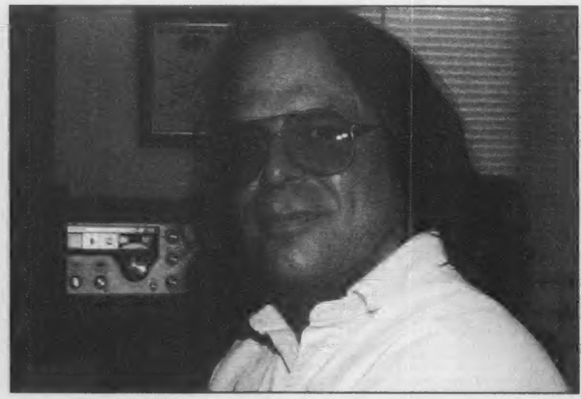

Photo C. Bill Blohm, who hopes to obtain his General class license soon.

WASHINGTON

Photo D. Hearing-impaired ten-year-old Peter Foresman is studying for his no-code test.

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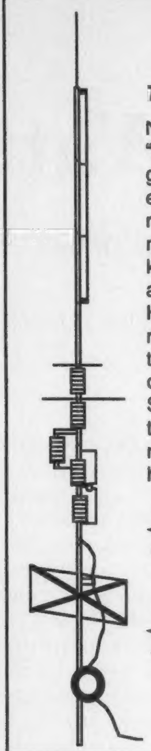

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A Simple Wattmeter

How much does your equipment cost to power?

by Edward C. Miller N7APE

At one time or another, most of us would like to get a view of the AC power consumption of some of our equipment, or maybe a grasp of the cost of having one unit or another running constantly. It's generally not something we would be on top of most of the time. Here is an idea for such a power-measuring device.

All that is needed is a small power transformer with a low-voltage secondary or a transformer from an old tube-type receiver. The winding voltages are not that important; it's the ratio that counts. If it has a 120-volt primary, and a secondary of 12 volts or less, it will do fine. Or, if you are one of the old timers, you may have a filament transformer. It would likely have a 120-volt primary winding with the secondary maybe 6.3 volts, center-tapped. It was the latter that I discovered among yesteryear's parts.

If there is nothing like that around your shack, a parts house should have a small transformer with a 120-volt primary, and perhaps a multi-tapped secondary with relatively low voltages (2 to 6 volts) between taps. I wouldn't recommend using low-voltage units such as mini-audio units, as their insulation may not prevent breakdown, especially if the meter is used on a 240-volt line. What we are looking for is a fairly high primary to secondary ratio. The transformer I used had a ratio of 38:1 (120 V/3.3 V). To keep things simple, I will not refer to the windings as primary or secondary, but rather low voltage and high voltage.

The low-voltage winding is placed in series with the 120-volt line, and bridged with a very low-value resistance. The output of the high-voltage side is rectified and filtered, and its voltage measured by a meter. (The most desirable meter would probably have a 200 or 500 µA range; a lot of them are available on the surplus market). Although this circuit uses a micro-amp meter, it is really measuring the rectified and filtered voltage of the high-voltage winding. As this voltage is proportional to the voltage on the low-voltage winding caused by the current flow through it, the meter will, in fact, be a measure of the line current.

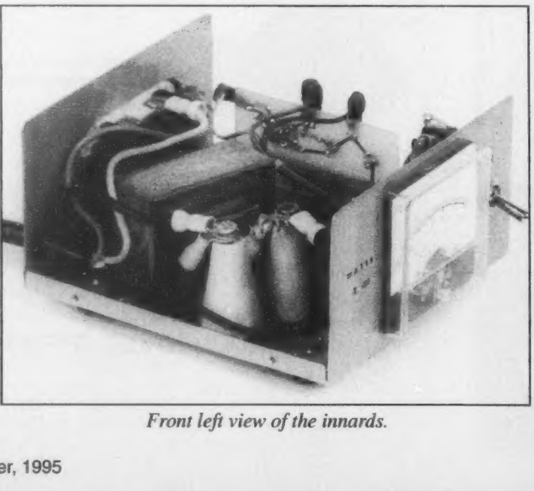
The resistor across the low-voltage winding should be of a value that will reduce the current in that winding to the minimum level that gives a meaningful voltage for the meter on the high-voltage side. A short section of heater element wire (obtainable at most hardware stores) was used for this purpose. Its value should be between .1 and .2 ohms. A practical step is to compute the ratio of the high/low windings. A ratio of 30:1 or better is best, but a ratio as small as 10:1 will do. Assuming that R-1 is one tenth of an ohm, and the ratio is 30 to 1, then 1 amp through it will produce a voltage on the high voltage winding of about 3.8 volts, and cause only a one-tenth-volt drop to the device whose power is being measured.

When the load is small (40 watts or less), the voltage drop across the rectifiers would reduce the accuracy of the measurement. That is, the reading on the meter would be nonlinear at the low end of its scale. Therefore, diodes D-3 and D-4 are placed in series with the meter, and are forward biased with the battery and R-5. Because this offsets the voltage drop across D-1 and D-2, the meter reading is accurate, even at very small loads. The meter shown in Figure 1 is a 200 µA calibrated zero to 5 (that is, zero to 500 watts at 120 volts).

Calibration is accomplished by applying 120 volts to the input circuit, with a known value load on the output (100 watt lamps, for example), and adjusting the R-3 trimpot to get the right reading. The meter reading will then represent the wattage at 120 volts.

This unit may also be used without modification for measurement at 240 volts. At this voltage, for a given wattage consumption, only half as much current is flowing through the measuring circuit. So the power reading must be doubled to get the true power drain.

Layout is not important. Although in the unit shown in Figure 2. the diodes, capacitors, and trimpots were mounted on a PC board, that certainly is not required. Point-to-point wiring and the use of standard-size potentiometers would do just as well. The power switch, in the AC line, should be capable of switching at least 5 amps. Although a DPST switch was used in the unit shown, the AC power could be switched with a heavy-duty SPST switch, with a mini-switch to disable the battery when the unit is not in use.



Front left view of the innards.

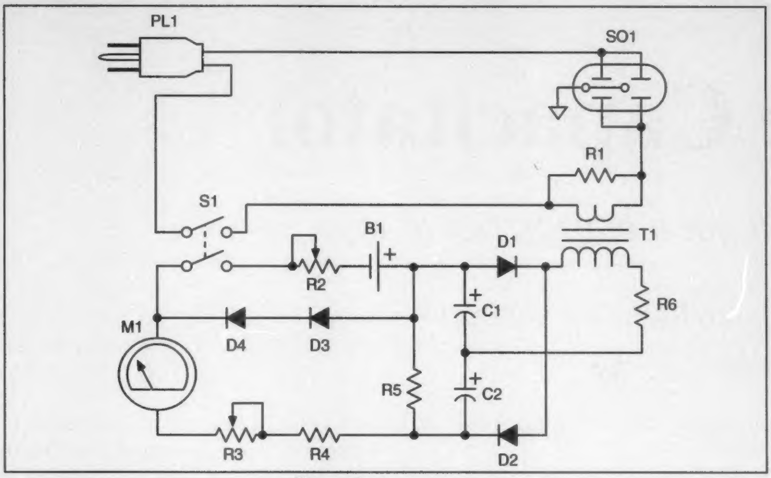


Figure 1. Power meter.

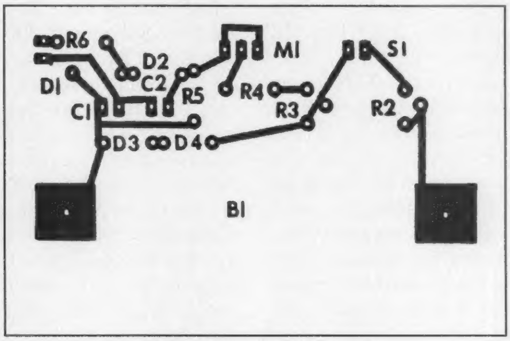
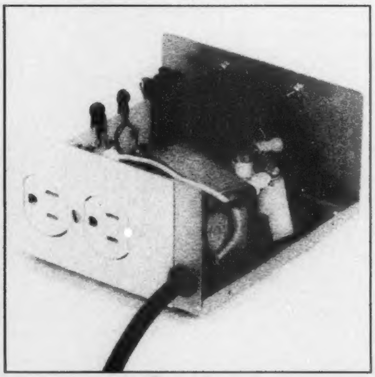


Figure 2. PC board pattern.

Many of the component values are dependent on the transformer chosen, and on the value of the shunt resistance. This includes the voltage ratings of the capacitors, and the value of the resistance in series with the meter.

If you have an AC voltmeter, it would be best, after all the parts are mounted, to leave the wires from the high-voltage side of the transformer disconnected from the rest of the circuit. Double-check that the resistor is solidly connected across the transformer low-voltage winding. Power it on, and measure the voltage across the high-voltage side with a 100-watt load. A reading of 1 to 3 volts should be expected. A reading much higher than 3 volts would indicate a need to use a smaller value for R-1; and a reading of less than 1 volt shows that the R-1 value should be increased.



Rear view

Parts List

B-1	AAA Nicad Battery
C-1, C-2	20 µF/25 V electrolytic capacitors
D-1,2,3,4	1 A, 100 V diodes
M-1	200 µA-meter
PL-1	AC Plug
R-1	0.1-ohm resistor (see text)
R-2, R-3	100K-ohm trimpots
R-4	15K-ohm 1/4-W carbon resistor
R-5	220K-ohm 1/4-W carbon resistor
R-6	680-ohm 1/4-W carbon resistor
S-1	DPST 10-A Switch
So-1	Standard AC socket for unit under test
T-1	Power transformer (see text)

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The Capacitator

You'll get a charge out of this!

by Brian Field VK6BQN

The following is a weekend-type project, simplistic in design, and, depending upon how well stocked your junk box is, cost should only be a few bucks.

The need for this device became apparent when I was trying to make a fairly long-term 555-type timer, and had difficulties only because the large capacitor I used was a bit leaky. The capacity read out OK on a capacitance meter, but the time was way out because the associated resistance was being shunted by the leakage resistance.

Reference to the *ARRL Handbook* suggested no better than to watch the charge/discharge action on an ohmmeter, which, when you think about it, tells you absolutely nothing because of the relatively low resistance. Even a FET-type meter is deceiving at 11 Meg, when the timing resistor itself is like 10M or so. "There has to be a better way."

So with necessity being the mother of invention, etc., the "Capacitator" was born.

What we want is something that will charge the capacitor to its rated voltage rather quickly, then *hold* the voltage there. If the capacitor is leaky, then the voltage will dissipate through the leakage resistance and be gone. That means we want to observe this voltage without the meter itself draining away the charge. Since everything commonly found that does this has a divider chain of around 11M, something else will have to be devised. An arbitrary value of 50M was chosen for this, as it was felt to be achievable; anything higher like, say, 100M would probably be problematical due to insulation leakage around flux, even finger dirt.

Charging is no problem, we merely use a different divider chain to do this, and arbitrarily chose 20k, so that at 100 V, the chain itself only draws 20 mA from the supply, thus making it small enough.

The whole idea, then, is to charge the capacitor from this supply, isolate it, then observe how long the charge stays there. And with a 50M output load, even a 1-μF capacitor can be observed without too rapid a "sag" through the meter. (T = RC, 50M x 1 μF = 50 sec., so only 2/3 of the charge should be gone in 50 sec, or total discharge should take [about] 3T, or 150 seconds.)

The voltage scales chosen were felt to reflect what is commonly found in the junk box, including 3-V tantalums. (Tants are very seldom leaky, but rather tend to be either open or shorted, especially if they have seen wrong polarity voltages.) 100-V was chosen as the maximum, due to safety considerations, and seldom is a 100-V or higher cap encountered nowadays, except in valve [tube] equipment. If finding a 9-position switch becomes a problem, then some of these voltages might have to be done without.

Notice in the diagram that there is a

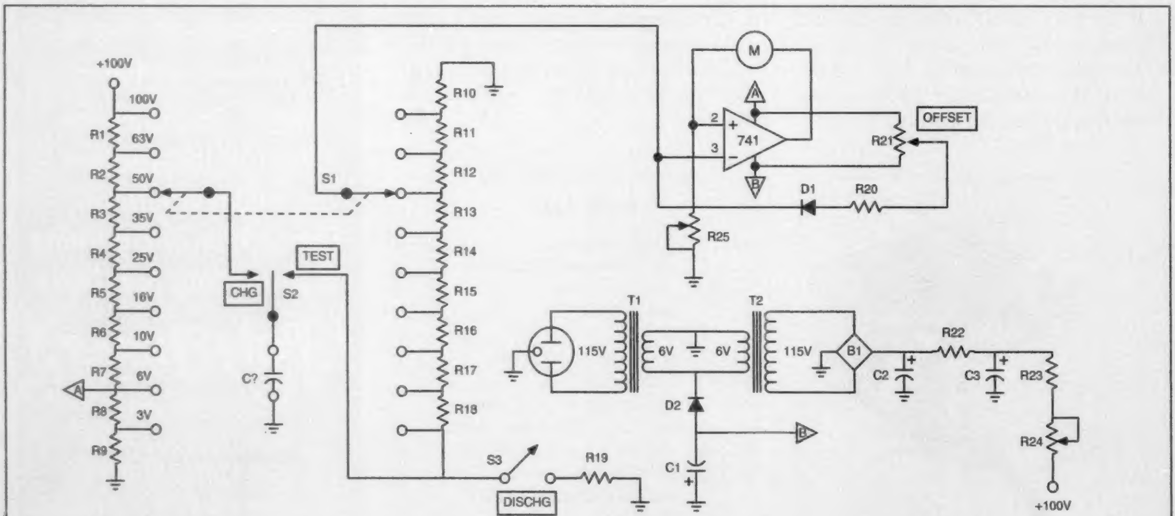

Figure 1. Schematic of the Capacitator.

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MICRO-MIKE

World's smallest FM wireless mike. Smaller than a sugur cube - including battery and mike. Two sets of SMT parts supplied in case you are clumsy! Terrific audio pick-up (pin drop at 5 ft) and transmit range of 300 ft. We include the battery (watch style), electret mike and even a tuning tool! Be a James Bond and learn SMT too!

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Pick the unit that's right for you. All units transmit a stable signal in the 88-108 MHz FM band up to 300' except for High power FM-4 and PB-1 Phone bug that go up to 1/2 mile.

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but with added mike pre amp **$7.95**
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very sensitive audio pickup **$14.95**
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MC-1, Micro size sensitive mike cartridge
for FM-1,2,4...**$2.95**

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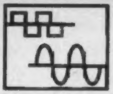

DDS (Direct Digital Synthesis) technology brings you a terrific audio generator at a fantastic price! Generates from 0. 01 Hz to 50 KHz with five digit LED display of frequency. Sine and square wave output adjustable 0-5 volt p-p. Frequency selected by direct keyboard entry and with handy continuous tune tuning knob. Crystal controlled accuracy of 10 ppm and two memories for rapid frequency changes. Retire that jury-rigged old generator and treat yourself to the pleasure of using a new state-of-the-art SG-550!

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Shortwave receiver kit, SR1..............................**$29.95**
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High quality, true AM broadcast band transmitter is designed exactly like the big commercial rigs. Power of 100 mW, legal range of up to 1/4 mile. Accepts line level inputs from tape and CD players and mike mixers, tunable 550-1750 KHz. Complete manual explains circuitry, help with FCC regs and even antenna ideas. Be your own Rush Limbaugh or Rick Dees with the AM-1! Add our case set for a true station look.

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SCANNER CONVERTER

Tune in on the 800-950 MHz action using your existing scanner. Frequencies are converted with crystal referenced stabilty to the 400-550 MHz range. Instructions are even included on building high performance 900 MHz antennas. Well designed circuit features extensive filtering and convenient on-off/bypass switch. Easy one hour assembly or available fully assembled. Add our matching case set for a professional look.

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SCN Matching case set......................................**$14.95**
SCN-1WT Assembled SCN-1 and case.......**$89.95**

SURROUND-SOUND/REVERB

Add concert hall realism to your stereo, TV or even 2-way radio! Easily sythesize a stereo effect from mono sources or richly enliven regular music. Add a big-voice reverb to your radio voice that others will envy! Our reverb/surround sound kit uses a Bucket Brigade IC Device for reliable solid-state performance. Adjustable reverb, delay and mix controls to customize your sound. Easily connected to radios, stereos, CB's and TV's. Plently of audio to drive a small speaker for stand-alone operation too. Experience the fun and realism that surround sound provides - without spending hundreds! Add our case set for a neat, pro look.

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Control virtually anything by Touch-Tone remote control. The URC-1 has 16 switched outputs, 4 adjustable voltage outputs (20 mV steps 0 to 5 VDC), two 10K digital pots (for volume, squelch, etc.) and 3 timers adjustable from 10 mS to 40 hours! Two level password control allows secure control and multi-level access. Six digit LED display shows currently entered codes and a crystal controlled touch-tone decoder provides reliable operation. There's nothing else like this unit, be in complete control of remote radios, thermostats, hi-fi's, homes or even factories with the URC-1. Add our matching case set for a handsome finish.

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URC-1WT Fully assembled URC-1 and case **$189.95**

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Tap into the world of commercial-free music and data that is carried over many standard FM broadcast radio stations. Decoder hooks to the demodulator of FM radio and tunes the 50-100 KHz SCA subcarrier band. Many radios have a demod output, but if your radio doesn't, it's easy to locate, or use our FR-1 FM receiver kit which is a complete FM radio with a demod jack built-in. These "hidden" subcarriers carry lots of neat programming - from stock quotes to news to music, from rock to easy listening - all commercial free. Hear what you've been missing with the SCA-1.

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FR-1 FM receiver kit..................................**$24.95** CFR Matching case for FR-1 ....**$14.95**

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Measure inductors from 10 uH-10mH and capacitors from 2 pF-2uF with high accuracy by connecting the LC-1 to any digital multimeter. Two pushbutton ranges for high resolution readings and we even give you calibration components to assure proper accuracy of your kit! Active filters and switching supplies require critical values, no one should be without an accurate LC meter. For a pro look, add our matching case set.

LC-1 LC meter kit ....**$34.95** CLC case set...**$14.95**

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Control the speed and direction of any motor. Use our SMD-1 for those nice steppers you see surplus, and our MSC-1 for DC motors. The stepper driver features variable speed, half step rotation, direction and power down mode, can drive most any stepper motor. Our DC driver features pulse width modulation control allowing full motor torque even at low speeds and can drive motors up to 50 VDC @ 10 Amps! Add our case set for a professional assembly.

SMD-1 Stepper kit ....**$24.95** MSC-1 DC motor kit......**$24.95**
CSMD SMD-1 case.......................**$14.95** CMSC MSC-1 case.......**$14.95**

STEREO FM TRANSMITTER

Run your own Stereo FM radio station! Transmits a stable signal in the 88-108 MHz FM broadcast band up to 1 mile. Detailed manual provides helpful info on FCC regs, antenna ideas and range to expect. Latest design features adjustable line level inputs, pre-emphasis and crystal controlled subcarrier. Connects to any CD or tape player, mike mixer or radio. Includes free tuning tool too! For a pro look add our matching case set with on-board whip antenna

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Quit spending big bucks for replacement battery packs, rejuvenate and condition your batteries for peak capacity. Advanced circuitry has optimized discharge before charge to eliminate memory effect and to condition batteries that have been poorly cared for in the past. Quick charge rapidly brings battery to full charge in less than an hour-just 15 minutes for some types! And "top-off" charge mode squeezes every last bit of energy into each cell for the absolute most capacity. Switch-mode regulator controls constant current charge while being monitored by a negative delta-V system that cuts off the fast charge at the exact point of full charge-batteries are charged, not cooked! Charges NiCads or NiMH packs from 2 to 10 cells (easily expanded) and current capacities up to 10 Amp-hours. Runs on 12 to 15 VDC. Quit cooking your batteries, buying new packs, waiting hours for recharge, get a Dr. Ni-Cad today! Available in money saving kit form or wired and tested with case at a special price. Kit builders: add our matching case set for a snazzy finish.

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CDN Matching case set...**$14.95**
DN-1WT Fully assembled Dr. Ni-Cad with case **$89.95**

SPEED RADAR

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual Doppler shift. Uses two 1-lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

SG-7 Complete kit..**$99.95**

STEREO PEAK HOLD BARGRAPH

Finally a dual LED bar graph with a peak hold display! Bar graph displays are neat and eye catching but their speed is their downfall - they just can't capture the peaks. Our kit is like two units in one, a fast display to show the signal and a long persistance display to capture peaks, similar units go for hundreds of bucks! We offer 3 models: Linear for general use, Semi-Log for audio VU meters, and Log for power displays. Dual - for stereo! - 10 segment multi-colored LED display for snazzy, eye grabbing display and easily set ranges for virtually any signals, from voltmeters to audio VU meters to audio power amps to SWR meters. Complete intructions for easy hook-up to most any device. Add our matching case set for a sharp looking unit.

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CSSD matching case set............**$14.95**
SS-70WT Assembled
SS-70 and case set **$79.95**

CRYSTAL RADIO

Relive the radio past with a crystal set like your grandfather built. Uses genuine Galena crystal and catwhisker. Several different types of radios are built, including standard AM broadcast, shortwave and even WW II foxhole style. To compare modern semiconductor detectors, we include a diode for comparison. No soldering required and we even give antenna ideas. Radio for free, get it now before Clinton taxes it!

CS-1 Crystal set kit **$19.95**

TOUCH-TONE DECODER

Grab Touch-Tone numbers right off the air, phone or tape. A simple hook-up to any radio speaker or phone line is all that is required to instantly decipher touch-tone phone numbers or codes. A 256 digit memory stores decoded numbers and keeps its memory even in the event of power loss. An 8 digit LED display allows you to scroll through the memory bank to examine numbers. To make it easy to pick out number groups or codes, a "dash" is inserted between sets of digits that were decoded more than 2 seconds apart. A "central-office" quality crystal controlled decoder is used allowing rapid and reliable detection of numbers at up to 20 digits per second! For a professionally finished look, add our matching case set. Start cracking those secret codes tomorrow with the Tone Grabber!

TG-1 Tone Grabber kit............**$99.95** CTG Matching case set........**$14.95**
TG-1WT Fully assembled TG-1 and case..**$149.95**

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Chatterbox digital voice storage unit will record your message of up to 20 seconds. Time is split up into four 5 second blocks which can be played separately or cascaded for longer messages. An LED display shows message location and current mode for easy operation. Nifty built-in interfaces allow simple connection to transmitters for automatic keying when the PTT is initially closed or after it is released. You can even loop your rig's mike through the Chatterbox. For contest or fun use, the CB-1 can drive an external speaker. Includes a built-in electret mike. For that finishing touch, add our matching case set.

CB-1 Voice recorder kit..................**$59.95** CCB Matching case set **$14.95**

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CIRCLE 34 ON READER SEVICE CARD

corresponding voltage tap on the "discharge" chain for each tap on the "charging" chain. This allows the meter to be set for full-scale deflection equal to that voltage. More on this under "Using the Capacitator."

Construction

The entire device fits into a 3" x 4" x 5" box, but if I had it to do all over, I would have made it into a slightly larger box. A lot of it depends upon whether you use a 2-inch or 3-inch meter. Do *not* spend big money on the meter, as the only points to look at on the meter are full scale and zero. *Any* meter movement will do; if you use other than a 1-mA movement, it's only a matter of adjusting R25 to make up the difference. The meter and R25 are made to read 3-V full-scale. So for a common 1-mA movement, R25 will be about 3k. Note that the meter resistance makes no difference.

S1 is a 2-pole 9-position rotary, and all the resistors are fitted directly to the switch terminals. S2 is an old telephone-type lever switch, with a center off. I adjusted the discharge side to have a detent, the charge side to have a spring return, as charging usually only takes a second or so (under, say, 10,000 µF). If you can't find one of these, you may have to settle for a rocker-type, but it's worth it to find the center-off type. I mounted this switch horizontally at the bottom of the front panel so that it could be operated with the thumb while holding the box steady with the rest of the hand. S3 is an ordinary NO push button, mounted on top of the box, next to the test terminals. Get used to discharging any cap before sticking your fingers where they shouldn't be! Even at a relatively low voltage of 25-V or so, a lan cap can make a nasty "snap" if not discharged gently through a resistance. There certainly isn't anything critical about the value of R19, but too low may allow too much sparking or pitting of the contacts after awhile; too high and you may have to wait awhile for larger caps to come all the way down. Do *not* use a dinky little switch for this reason; they just won't take the heat. Use instead one of the American or British large black types rated at 2 or 3 amps.

U1 is an ordinary everyday op-amp, 741 probably the cheapest/easiest to find. R21, R24, and R25 are all screwdriver adjust pots. Not necessary to use 10-turn types, but if that's what you have, OK. There isn't really anything critical in the value of these either. R20 can be any value above a few Megs. D1 is used to isolate the offset voltage from the discharge path, else the discharging cap would bleed off through here, shunting the 50-Meg chain.

In calculating the divider resistors, many nonstandard values are needed. Readers are referred to my freeware program (found on all good BBSs as "Divider.bas" or the Q-basic version, "DividerQ.bas") which can find a resistor pair to make almost any resistance required. Common 10% resistors are used to make up these combinations and are listed here in the parts list. It's much easier to put two resistors in parallel around the switch terminals than to use two in series.

The power supply uses two back-to-back transformers, they can be either 6- or 12-V types, just so long as they are the same. This gives us isolation from the line, as well as the opportunity to make a small negative voltage for the op-amp. Since it needs only 1 mA or so, an ordinary glass diode will do for this. There is absolutely nothing critical about component values here, or indeed in the +100 supply, except WVDC on the two filter caps, and of course the bridge must be able to handle 200 PIV. No regulation is provided. Not worth the bother.

Note that if a 12-volt transformer is used at T1, then "point A" should be moved to the junction of R6 and R7, to make the offset adjustment at R21 easier. The bridge, two caps, and R22 I hard-wired into place where they would fit between the trannies, meter, etc. Everything else I put onto a small piece of perfboard for convenience.

Smoke Test/Calibration

If you don't get that burning phenolic smell when plugging it in, then calibration is only a matter of a voltmeter and 2 minutes. Put a 100-V meter on the top of R1 and set R24 for 100 volts. Depending on what you used for C2 and C3, R23 may have to be changed to bring R24 into range. Now put the voltmeter on the point between R8 and R9, and ensure that this point is 3.0 volts. This is more important since it will be used to calibrate the meter itself. If it is off by more than a tenth of a volt or so, adjust the values of R8 and R9 to get it there. (All this with S2 in the open, or center position.)

Next, attach a temporary lead from this same point (junction of R8 and R9) to pin 3 of the op-amp. Adjust R25 for the meter to read full scale. This now makes the meter a 3-V f.s. meter. It will always be this, because at higher voltages the resistor chain divides the applied voltage down to 3-V.

Lastly, remove the temporary lead and adjust R21 for meter zero. You may have to reiterate these two steps once or twice to get the desired result. That's it! The Capacitator is now ready for use.

Using the Capacitator

The best way to show how to use the Capacitator is to walk through the whole process with an example. Hook up the capacitor to be tested to the terminals (mind polarity!). Let's use a 100-µF, 6-V electrolytic for this example. Set the voltage selector to 63-V. Flick the lever switch over to charge for two or three seconds. Then move it to "test" and the meter should immediately go to full scale. And *stay* there for quite a while. It's OK to watch the voltage *slowly* bleed off: the 50-Meg divider is doing this. If leakage is of *real* concern, set the lever switch to the center. The capacitor now is completely isolated. Go have a cuppa coffee and come back in half an hour or so, again put the lever switch on "test," and the voltage (theoretically) should still be at full scale. (This is where we learn that *all* electros, even brand-new ones, leak a little.) With practice, especially on smaller caps, you will quickly get the idea of what is leakage in the cap, and what is being drained off by the divider chain. In the earlier example of a 1-µF capacitor, we say that 2/3 of the charge will be gone in 50 seconds, which should give some idea of what to expect.

We encountered an unexpected bonus after construction of the device, in that when we are charging a capacitor, the current drawn by the cap upsets the amount of current being drawn through the divider chain, hence the zero offset voltages change slightly, and the meter dips below zero. As the capacitor nears completion of its charging, the meter returns to zero. This serves as an indicator that the capacitor is charging while holding the lever switch in "charge." On small caps, this is hardly noticeable; on larger ones, you now know how long to hold it on charge.

Every now and then, charging and charging will only get the cap to read about half scale. This indicates (obviously) the cap won't take the full charge. It does *not* mean the cap is bad, only that it needs to be reformed. Sometimes charging, discharging, charging again, etc., will bring it good. Other times, set the voltage two steps below the rated voltage, charge it up, leave it sit there a short time, discharge it,

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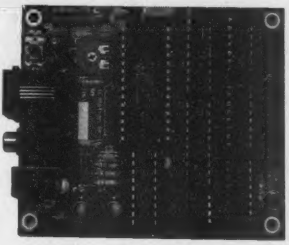

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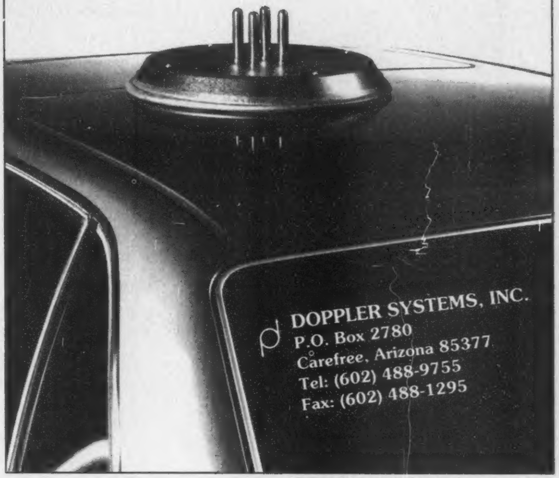

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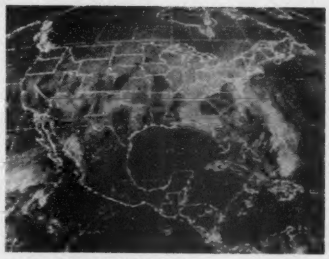

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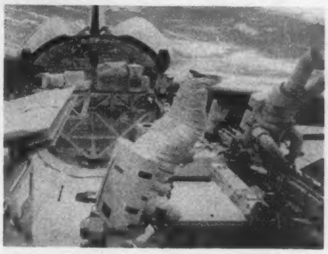

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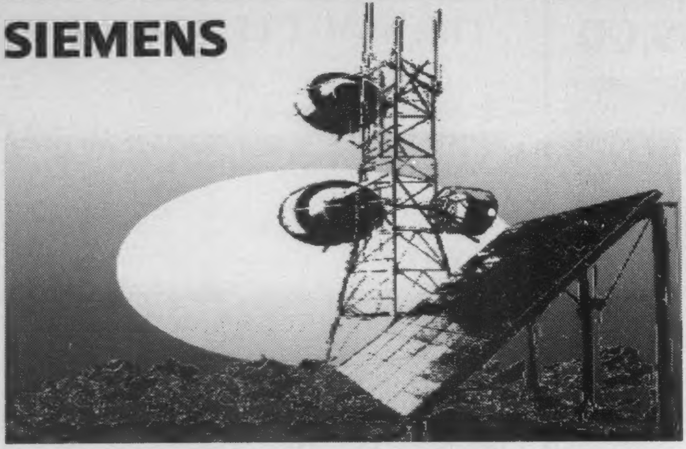

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charge it up to the next higher voltage, etc., and maybe it will come good by the time you return to the rated voltage. Note was made that when a cap is like this, the meter will stay below zero when charging, indicating that it is always drawing current. Right here is where you know that, as is, you can't really use it in your circuit!

Take a "Touch Plate"

If you have a handful of pullouts to check, with really short leads, it's a lot easier to make a touch plate, than to fiddle around with alligator clips, holding the clips apart with one hand, etc. A touch plate is any piece of *plated* circuit board (bare copper soon tarnishes and it's hard to make a good contact with bare leads), about 1" by 3". Cut a separation down the middle of the foil with a hacksaw, or whatever, about 1 mm wide. Solder leads on each of the two pads and hook *them* up to the meter. Now all you have to do is hold the cap by the middle, leads pointing down, and touch them into the pads. This little plate can be used for other testing devices as well, and I have used a 3-way for transistors. (Use your imagination.) Fair warning, though: when using the 63- or 100-volt ranges, don't put your fingers where they shouldn't be. Note the negative side is grounded, so if your hand rests against the plate, make sure it's *that* side.

Parts List

B1	200-PIV bridge rectifier (WO2)
C1	47-µF, 25-V electrolylic
C2, 3	4-µF, 160-V electrolylic
D1, 2	any glass diode, e.g., 1N4148
R1	7400-ohm 8200I82k
R2	2600-ohm 3900I8200 or 4700I5600
R3	3000-ohm 4700I8200
R4	2000-ohm, 2 x 1k series
R5	1800-ohm
R6	1200-ohm
R7	800-ohm 820I33k
R8, 9	600-ohm 1200I1200 or 1kI1500
R10	1.5M
R11	880k 1.2MI3.3M
R12	620k 680KI6.8M
R13	1.2M
R14	1.7M 2.7MI4.7M or 3.3MI3.3M
R15	3.3M
R16	5.6M
R17	10M
R18	25M 10M series 15M
R19	120-ohm, 2-W (not critical, see text)
R20	10M (not critical, see text)
R21	100K trimpot (not critical, anything over 20k)
R22	12-ohm, 1/2-W
R23	1k
R24	1k trimpot
R25	5k trimpot
S1	2-pole 9-position rotary switch
S2	2-pole lever switch (see text)
S3	pushbutton, n.o. (see text)
T1, 2	115-V/12-V or 115-V/6.3-V— both to be the same.

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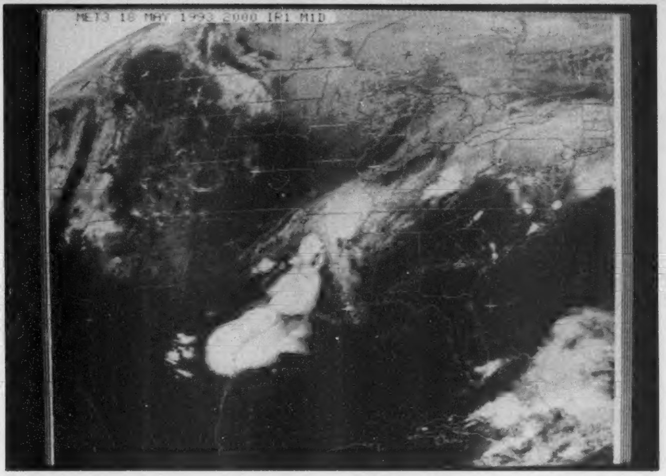

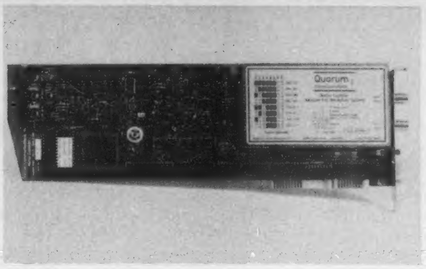

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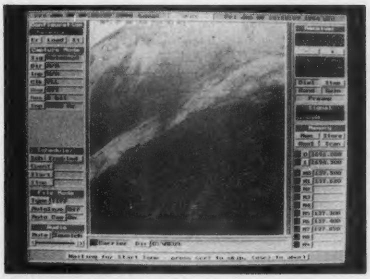

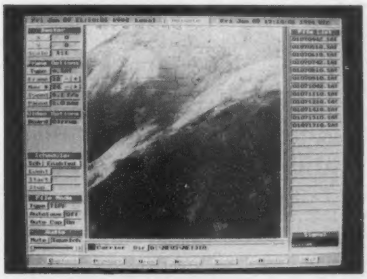

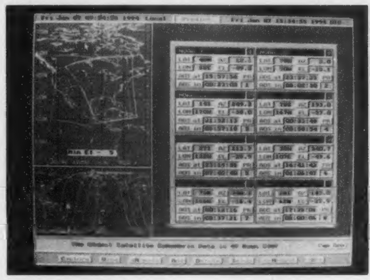

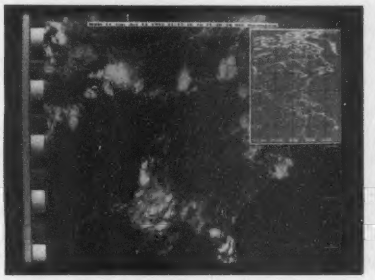

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by J. Frank Brumbaugh KB4ZGC

Most hams have occasional use for a relatively clean source of audio within the most important range: 300 to 3,000 Hertz. If that source is variable in both frequency and level, it will be even more useful. The commercial audio generators available are far too expensive for most hams, and their extended range of frequencies is far wider than most hams could ever use. You can construct simple, fixed-frequency audio oscillators for specific—but generally only approximate—frequencies when the need arises, if all parts needed happen to be in the junk box. But usually Murphy makes certain that at least one critical component is missing and cannot be located.

What is needed is a simple, inexpensive, accurate variable frequency generator that can be built from mostly junk box parts, easy to put together and easy to use. It should have a reasonably clean sine wave output available at both high and low impedance levels, both of which are variable at will. Even though the frequency generator may not be used every day, it will be on the shelf when the need arises, and once you have it you will find more and more uses for it.

One of the generator's most obvious uses is constructing and adjusting active and passive audio filters, and measuring their bandwidths. Two can be used for two-tone testing of sideband transmitters. It can be used as a code practice oscillator. It is also handy for checking the audio stages of many kinds of equipment from ham gear and portable radios to TV sets and public address systems. No doubt many more uses can be found.

The instrument described here represents an entirely different approach to the generation and control of audio frequencies. It combines the principles of high-frequency heterodyning with the "rubbering" of a crystal oscillator. The difference frequency between two stable, crystal-controlled oscillators, one of which is variable over a few kHz, provides a useful range of accurately known audio frequencies. Because these audio frequencies are generated by a pair of crystal oscillators, the output frequency will be as stable as the crystal oscillators, especially important in the design of active audio filters.

Circuit Description (See Figure)

U1, a 74LS00 Quad 2-input NAND Gate chip (or a 4011 with different pinout) is connected to form two separate crystal oscillators, each using two of the four NAND gates on the chip. Surplus microprocessor crystals at a frequency of 10 MHz are used to ensure a more than sufficient range of audio frequencies at the output of the generator.

Both 10-MHz outputs from the oscillators are fed through emitter followers, Q1 and Q3, which serve to isolate the oscillators from each other and prevent the pulling of one oscillator as the other is rubbered.

Outputs from both emitter followers are fed to Q2, which is a simple mixer. Because the sum frequency of approximately 20 MHz is so far removed from the desired difference frequency in the lower audio range, it is ignored rather than being shunted to ground. The difference frequency, controlled by C3, an air variable capacitor in the rubbered crystal oscillator circuit, is applied through C8, 4.7 µF, to the top of LEVEL control, R13, a linear 10k-ohm potentiometer.

The position of the wiper of R13 establishes the level of audio available at J1, the Hi-Z output connector. At the same time, the audio at the wiper of R13 is also applied through C12, 4.7 µF, to the base of Q4, an emitter follower which produces its output through C13, 470 µF, to J2, the Lo-Z output connector. Thus, the single level control varies both high- and low-impedance audio levels simultaneously.

U1 is supplied with +5 VDC through U2, a 78L05 regulator. Transistors are all supplied with operating voltage directly from the 9-volt battery. Current drain is a nominal 30 mA. No LED is included to hold current drain to a minimum. A 9-volt alkaline battery is rated at about 565 mA hours, and the additional current required by an LED would reduce battery life unnecessarily. However, if the station power supply is used to power this generator, addition of an LED to indicate Power-On would be okay.

Theory of Operation

One fixed crystal oscillator and one variable crystal oscillator are separately buffered through a pair of emitter followers, Q1 and Q3, then are combined in mixer, Q2. The difference frequency between the two crystal oscillators is taken from the collector of Q2 and applied to the LEVEL control, R13. Adjustable output from R13 is applied through C9 to the HI-Z output connector, J1, and also through C12 to the base of emitter follower, Q4, whose low-impedance output is routed to Lo-Z output connector, J2.

Parts

Because this is primarily a junk box project, most parts—except the variable capacitor—will be found in your junk box, or are readily available from Radio Shack and numerous mail order electronic parts dealers. The best source for a suitable variable capacitor is the hamfest flea market. Other hams may also have just what you need, especially older hams who may still have war-surplus capacitors in their junk boxes.

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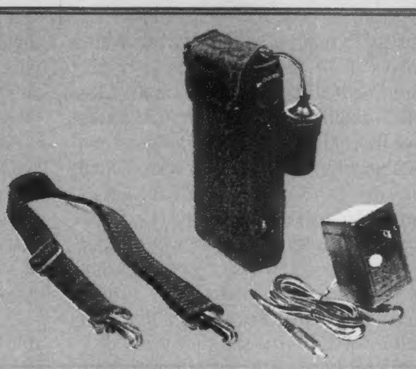

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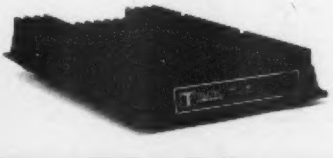

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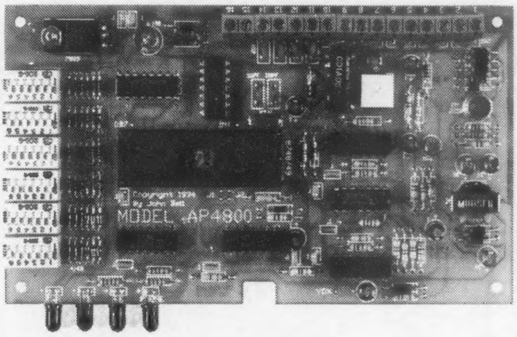

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mounts through a shaft hole but with a pair of 4-40 machine screws, is preferred, and it is also fairly small. Most still available on the used parts market have no shafts, and are designed as padder capacitors and adjusted with a small screwdriver. However, you can make a shaft from a short length of 1/4" copper tubing by carefully filing down the portion with the screwdriver slot and reaming out one end of the copper tubing. The shaft can then be soldered to the capacitor. Because the shaft (or screwdriver adjust) of an APC capacitor extends through the panel through an oversized hole, the rotor is not grounded. A large plastic knob on the shaft reduces the inescapable frequency shift caused by your fingers.

If a tuning capacitor intended to be mounted with a nut through the panel is used, it must have both rotor and stator insulated above ground. Fiber washers—one flat and one shoulder—can be used to insulate effectively this type of capacitor from ground. Another method is to make an oversized hole in the panel through which the shaft bushing will protrude without touching the panel. Back up this hole with a small sheet of insulating plastic or phenolic, and mount the capacitor with its shaft bushing and nut through the insulating sheet, which is fastened to the panel with two small machine screws, lockwashers, and nuts.

As a temporary measure, if you use an APC-type capacitor and need to use this generator before adding a shaft and dial to calibrate, you can use a small screwdriver to set the needed frequency (it should be insulated) and a frequency counter to determine the frequency.

One source of inexpensive air variable capacitors is Fair Radio Sales, Inc., P.O. Box 1105, Lima, OH 45802-1105. Suggested is Catalog No. 657-J3, 8-55 pF, 79 cents, a screwdriver adjust APC type. Also, Catalog No. CT13E099M, 10-100 pF, $1.50; Catalog No. 6CT1C075, 6-75 pF, $1.25, all of which are APC types to which you'll need to add a shaft.

If the capacitor you use has too much maximum capacity, rotor plates can be removed—carefully—with needle-nose pliers. If its minimum capacity is too low, you can add a small trimmer capacitor in parallel.

Assuming you must purchase all new (surplus) parts and manage a lucky trade or purchase of a usable variable capacitor, the total parts cost, excluding the case, will be under 10 dollars.

Because the heart of this generator operates at 10 MHz, it is strongly recommended it be constructed in an aluminum box, or a case made of copper-clad printed circuit board material.

Construction

I recommend using a Radio Shack general-purpose printed circuit board (276-150), which is what I used. You can also use perf board. Because the circuit diagram (see Figure) is far larger than the finished generator, there is plenty of room on the Radio Shack board.

You will find it easiest to mount some resistors vertically, and make certain all the parts associated with U1 are mounted as close to it as possible. A socket can be used, but it is not required for U1. If you decide to use a 4011 chip instead of a 74LS00 to reduce current drain, make the necessary changes in the circuit caused by the different pinout. Although ceramic disk capacitors can be used, monolithic capacitors are preferred because they are much smaller. You can use any small signal NPN transistors instead of the 2N3904 types specified, without any problems.

CAUTION: Make certain that both shaft and rotor of the variable capacitor,

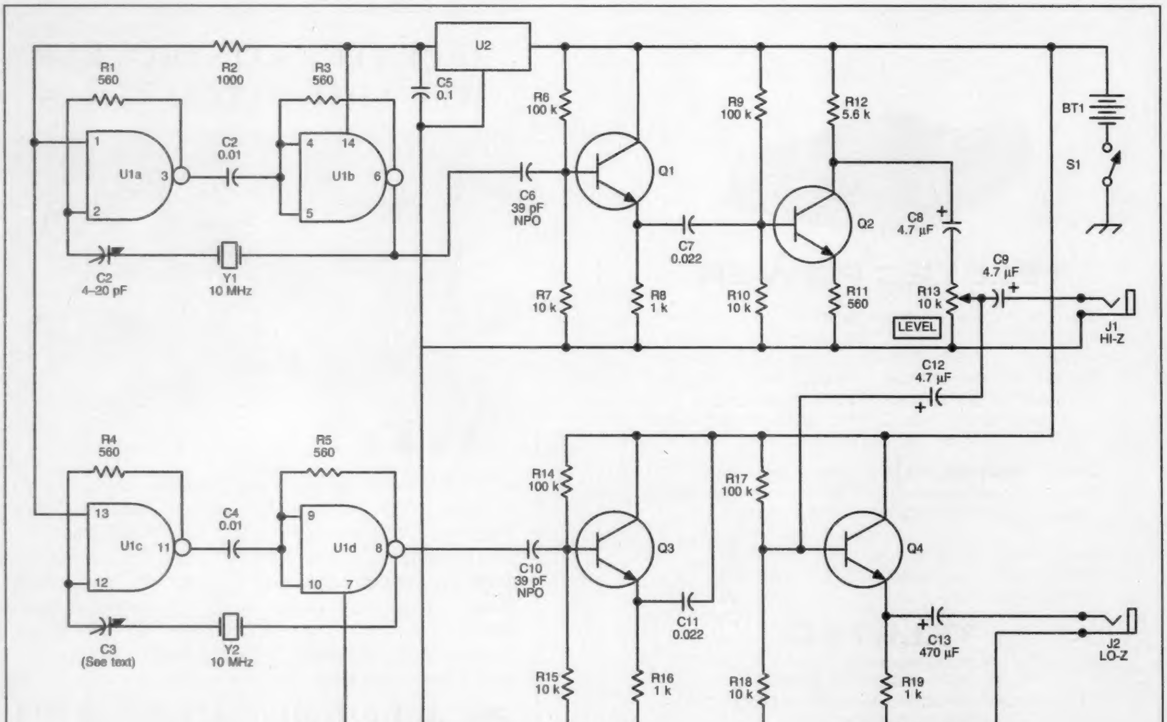

Figure. Schematic diagram of crystal-controlled audio generator.

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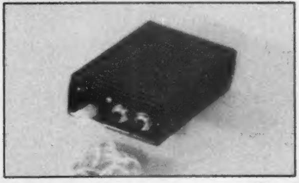

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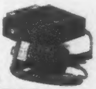

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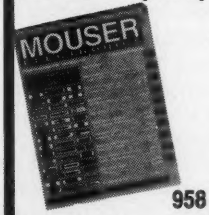

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C3, are insulated from ground. A grounded capacitor will prevent one oscillator from functioning, and no audio output will result.

Use a large plastic knob on C13. The output frequency will change slightly when your fingers are on the knob, and return to normal when you take your hand away. This is a minor drawback, but the only way to eliminate it is to use a rather large enclosure, and an insulated shaft coupling on C13, with a grounded shaft bearing at the panel. Shaft couplings of any kind are scarce and very expensive, as well as taking up more room. However, you can make an insulated shaft coupler from a 1/2"-square or round plastic rod. Drill a 1/4"-diameter hole through it from one end to the other. On one side, drill and tap two small holes for setscrews into the central hole. A defunct potentiometer can be taken apart to provide both a shaft bearing at the panel, and the needed short piece of shaft.

If you wish to eliminate the 9-volt battery, substitute a 78L09 regulator and operate this generator from your station power supply. Although I didn't try it, there is no reason it shouldn't function perfectly, though with increased output, from 13.8 VDC.

Although 10-MHz crystals are specified, you may use any crystals that are marked for the same frequency, as long as they are no higher in frequency than 13 MHz. The 78LS00 will not oscillate much above 13 MHz. The higher frequency you choose, the greater the resulting audio range will be. Surplus microwave crystals are usually produced within 500 ppm, which means the actual oscillation frequency, without series capacity, can be anywhere between 9.9925 and 10.0075 MHz. Placing a capacity in series with a crystal will increase its frequency of oscillation by about 2 kHz, and increasing the capacity will lower the frequency.

Calibration

Because of the wide tolerances of microprocessor crystals, calibration is a bit more complex than tweaking a trimcap. I ended up using a 25-pF variable capacitor in series with a 9-pF NPO capacitor. This resulted in a frequency range of about 100 Hz to over 3,000 Hz. Because your crystals are different, your treatment of C3 will no doubt be different. You will have to try different values of tuning capacitor; you will probably have to vary this value with either or both series and parallel small value capacitors.

Basically, adjust C3 to minimum capacity, then adjust C1 for a frequency lower than 300 Hz, using a frequency counter connected to the Lo-Z connector, J2. Then slowly advance C3, monitoring the frequency until it is at maximum capacity. If the U1c-U1d oscillator stops oscillating, your maximum capacity is too high. Either remove rotor plates, as suggested earlier, or try different values of small capacitors in series with C3. Each time you change the effective value of the variable portion of C3, you will again have to adjust C1, with C3 at minimum capacity, for a frequency at the low limit you select, normally a bit below 300 Hz. Again set C3 at maximum capacity and check the frequency.

It may take several attempts to get the range encompassing the desired 300–3,000 Hz spectrum. Initially, the range you measure will probably cover from 300 to 5 or 6 kHz. This indicates that the amount of capacity variation of C3 is too high, and points to the need for reducing it. Series capacitors of various small sizes will allow you eventually to capture the needed 300–3,000 Hz range.

It will help also to feed the output signal through a small amplifier into a speaker. Not much amplification will be needed, and in fact, the Lo-Z output will produce a weak signal when fed directly into a speaker. There may be occasions where, while adjusting C3 from minimum capacity, you will go through zero beat. This requires readjusting C1 slightly. The frequency change while adjusting C3 through its range should be smooth, from low frequency to high, as C3 is adjusted from minimum to maximum capacity.

Unfortunately, rubbering a crystal with a capacitor does not result in a linear change in frequency. Thus, you will find that the low frequencies, as you mark calibrations on the dial, will be crowded, while the higher frequencies will be more spread out. However, while this makes adjusting for a frequency below 1,000 Hz—as when checking an active or passive CW filter—a bit more difficult, you can be assured that the frequency you set is both accurate and completely stable, because it is crystal controlled.

Conclusion

Because I neither own an oscilloscope nor have access to one, I could not observe the waveform. It sounds clean to my ear from a speaker fed by an LM380 amplifier with the input gain turned low to avoid any distortion in the amplifier.

Should anyone who builds this generator find any distortion in the waveform, which should be a sine wave or very close to it, he or she may be required to change some parts values associated with the four transistors, Q1 through Q4. Because I have no way of knowing if distortion exists, I cannot make any suggestions as to possible changes.

I have used this instrument primarily for checking peak frequency and bandwidths of active CW filters. It functions as designed, and provides the information I look for.

The C3 capacitor I used—and no doubt yours will be similar—has "constant capacity" plate shapes; its capacity varies linearly as the plates are enmeshed. An older ham might be able to help you locate a tuning capacitor with "constant frequency" plate shape, such as were very common in the 1930s. Using this plate shape should spread out the low-frequency end of the frequency range, but may also tend to crowd the higher frequencies. With this plate shape, capacity change is slow as the capacitor is adjusted from minimum capacity, and becomes much more rapid toward maximum capacity.

Parts List

BT-1	9-volt battery
C1	4-20 pF trimmer capacitor
C2, C4	0.01 µF monolithic capacitor
C3	Air variable capacitor (see text)
C5	0.1 µF monolithic capacitor
C6, C10	39-pF NPO monolithic or disk capacitor
C7, C11	0.022 µF monolithic capacitor
C8, C9, C12	4.7 µF 16-volt electrolytic capacitor
C13	470 µF 16 volt electrolytic capacitor
J1, J2	Output connectors, builder's choice
Q1, Q2, Q3, Q4	2N3904 or equivalent NPN small signal
R1, R3, R4, R5, R11	560-ohm, 1/4-watt 5% resistor
R2, R8, R16, R19	1k-ohm, 1/4-watt 5% resistor
R6, R9, R14, R17	100k-ohm, 1/4-watt 5% resistor
R7, R10, R15, R18	10k-ohm, 1/4-watt 5% resistor
R12	5.6k-ohm, 1/4-watt 5% resistor
R13	10k-ohm linear taper potentiometer
S1	SPST switch
U1	74LS00
U2	78L05
Y1, Y2	10-MHz microprocessor crystal (see text)

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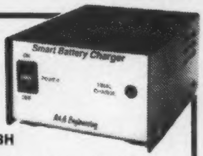

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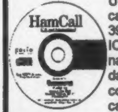

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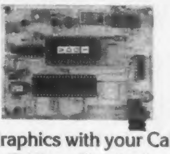

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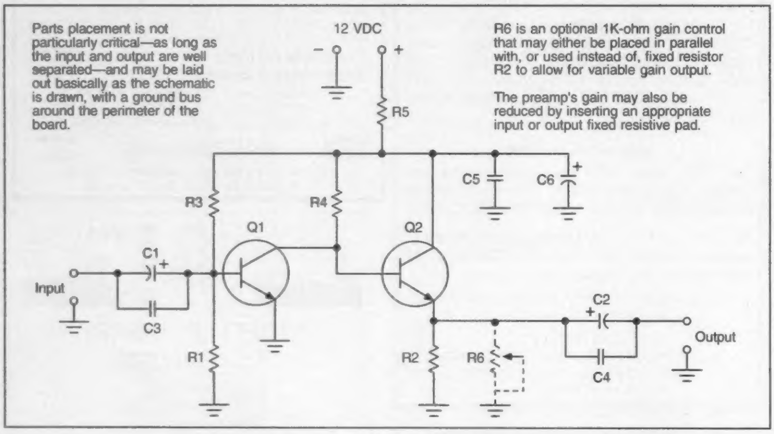

Parts placement is not particularly critical—as long as the input and output are well separated—and may be laid out basically as the schematic is drawn, with a ground bus around the perimeter of the board.

R6 is an optional 1K-ohm gain control that may either be placed in parallel with, or used instead of, fixed resistor R2 to allow for variable gain output.

The preamp's gain may also be reduced by inserting an appropriate input or output fixed resistive pad.

Figure 1. Wide-Band preamp.

Here's a handy audio/RF preamplifier that has many uses in and around the ham shack for generally boosting a low-level AF or RF signal. It can be used to provide greater input to a test instrument or for boosting a weak signal into an add-on peripheral. The beauty of this particular circuit is that it's easy to build, and has no coils to wind nor exotic parts to obtain. In fact, everything you'll need is available at your local Radio Shack, yet it will provide clean amplification from less than 50 Hz in the audio spectrum all the way up to over 100 MHz in the RF range. It's not intended for extremely low-noise preamplification, but it will do a reasonably good job in most applications where just some easily-supplied addi-

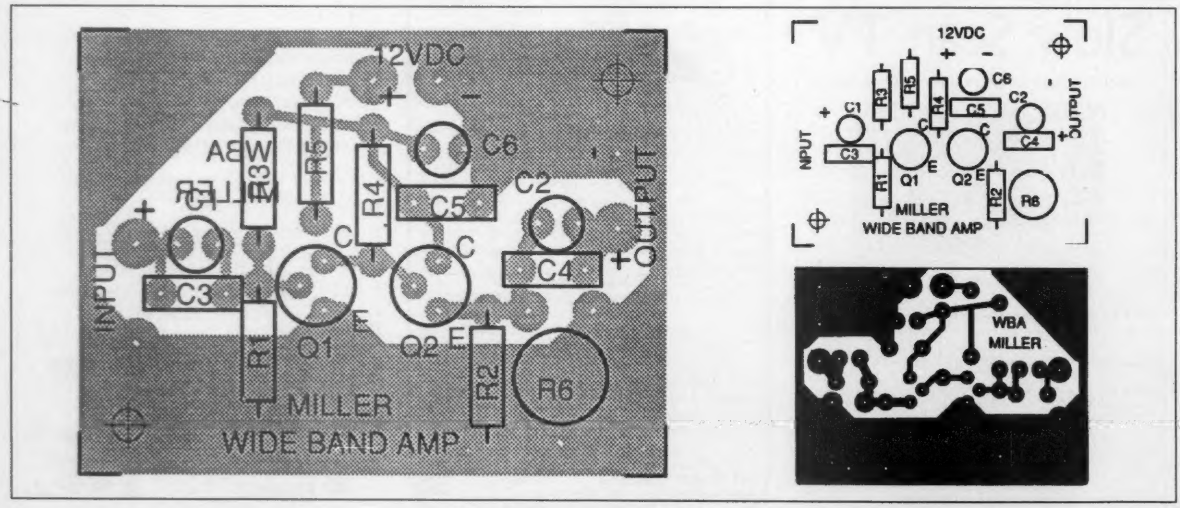

Figure 2. The preamp circuit board.

tional gain is needed. If you intend to use this circuit as a mike preamp around high RF power, some RFI-proofing (limiting the RF end of the response curve with ferrite beads and RF bypass capacitors) would be well advised.

Construction can be done on a perf board, keeping all leads as short as possible. The specifications and parts list are shown below.

Specifications

Usable frequency range: AF from 50 Hz to RF over 100 MHz, with a gain of +35dB at 100 kHz, +30dB at 10 MHz, and +17dB at 100 MHz. The noise is under 10 microvolts across 50 ohms (greater with a higher terminating impedance). The output is 100 millivolts or better into 50 ohms and 500 millivolts or better into 600 ohms.

The power supply requirements are 12–15 VDC at about 10 mA. The output begins to drop with less than a 12-V supply, and audio linearity begins to suffer below 10 V at maximum input. The input should be kept below about -30 dBm or 30 millivolts (.03 V rms). Noticable flattening of the waveform begins with inputs greater than about -20 dBm or 100 millivolts (0.1 V rms).

Parts placement is not particularly critical, as long as the input and output are well separated. It may be laid out basically, as the schematic diagram (see Figure 1) is drawn with a ground bus around the perimeter of the board. R6 is an optional 1k-gain control that may either be placed in parallel with, or used instead of, fixed resistor R2 to allow for variable gain output. You can also reduce the preamp's gain by inserting an appropriate input or output fixed resistive pad. 73

Parts List

Cl, 2	1-µF 35 V tantalum capacitors RS #272-1434
C3, 4, 5	.01 µF ceramic disc capacitors RS #272-131
C6	10-µF 35 V vertical electrolytic capacitor RS #272-1025
Q 1, 2	2N3904 transistors RS #276-2016
Rl	4.7k 1/4-watt RS #271-1330
R2	2.2k 1/4-watt RS #271-1325
R3	15k 1/4-watt RS #271-1337
R4, 5	330-ohm 1/4-watt RS #271-1315
R6	optional 1k micro-sized potentiometer RS #271-280
Misc.	perf board, bus wire, enclosure, input/output connectors, etc. as needed.

The circuit board is available from FAR Circuits, 18N640 Field Ct., Dundee, IL 60188, (708)-836-9148 voice or fax, for $3 each plus $1.50 shipping. Credit card orders over $20, or a $2 service charge for under that amount. You might as well build several of these handy preamps while you're at it anyway.

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12GA 65/30 "BARE COPPER" PVC INSULATED	.17/FT	.15/FT
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The Simple Simplex Repeater

An easily built project for interfacing with most transceivers

by Chris B. Sakkas KB8ITU

The Simple Simplex Repeater is a low-cost, easy-to-build project that, when interfaced with a transceiver, acts as a limited simplex repeater. Unlike most repeaters, a simplex repeater operates on a single frequency by recording the incoming transmission and playing back this recording on the same frequency. Operators who would otherwise not be able to contact each other directly can use a simplex repeater operated by another party to communicate. The Simple Simplex Repeater is handy in these situations and for use during emergency conditions.

The Simple Simplex Repeater is easy to interface to most transceivers, and can be built using readily available parts. Only three ICs and a handful of other components are needed to build the project. The core of the project is the ISD1000A Voice Record and Playback IC, available from Radio Shack, that stores up to 20 seconds of audio from an incoming transmission. When the incoming transmission has ended, the repeater keys the transceiver and plays the recorded transmission.

Design

Figure 1 shows the schematic diagram for the Simple Simplex Repeater. Point J1 is the input of the carrier-operated squelch (COS) signal from the radio. A received audio signal is said to be present when the COS signal is greater than 0.7 V, switching the collector of transistor Q2 to ground. The play/record (P/*R) pin of U1, the ISD1000A, then becomes low, placing U1 in record mode. NAND gates U3B and U3C are set up as inverters, and thus generate a high output. D flip-flop U4A is clocked on this positive edge, therefore making the Q output high. NAND gate U3A has both inputs high, therefore generating a low input to the power down (PD) pin of U1. The resistor R2 and capacitor C6 combination is used to generate a brief delay.

After COS drops below 0.7 V, the P/*R pin of U1 is made high, placing U1 in play mode. D flip-flop U4B is clocked on the positive edge, making the Q output high, which keys the PTT of the radio by switching transistor Q1. The R3-R4-C7 combination works as a negative-edge triggered negative pulse, which places the output of NAND gate U3A high for a brief period to allow U1 to enter playback mode.

When play is complete (or the audio memory is full), the end of message (*EOM) pin of U1 goes low. This clears U4A and U4B, allowing the PTT to be released and U1 to power down. The play sequence is entered if this state is created by a memory full condition after COS drops below 0.7 V.

Potentiometer R1 controls the volume of the audio out signal. A transformer can be used to match the output impedance to the radio, if desired.

U2 is a 5 V voltage regulator included in the design to allow connection to various unregulated DC supplies between the ranges of 7 V and 12 V. If, however, a regulated 5 V supply is used to provide power, U2 can be eliminated and the regulated supply can be connected to the V_{CC} points in the diagram.

Interfacing

The Simple Simplex Repeater can be interfaced easily to most radios. Six in-

Parts List for the Simple Simplex Repeater

Semiconductors
U1—ISD1000A Voice Record/Playback IC (RS 276-1325)
U2—7805 5 V voltage regulator
U3—74LS00 quad NAND gate IC
U4—74LS74 dual D flip-flop IC
Q1, Q2—2N3904 NPN transistors

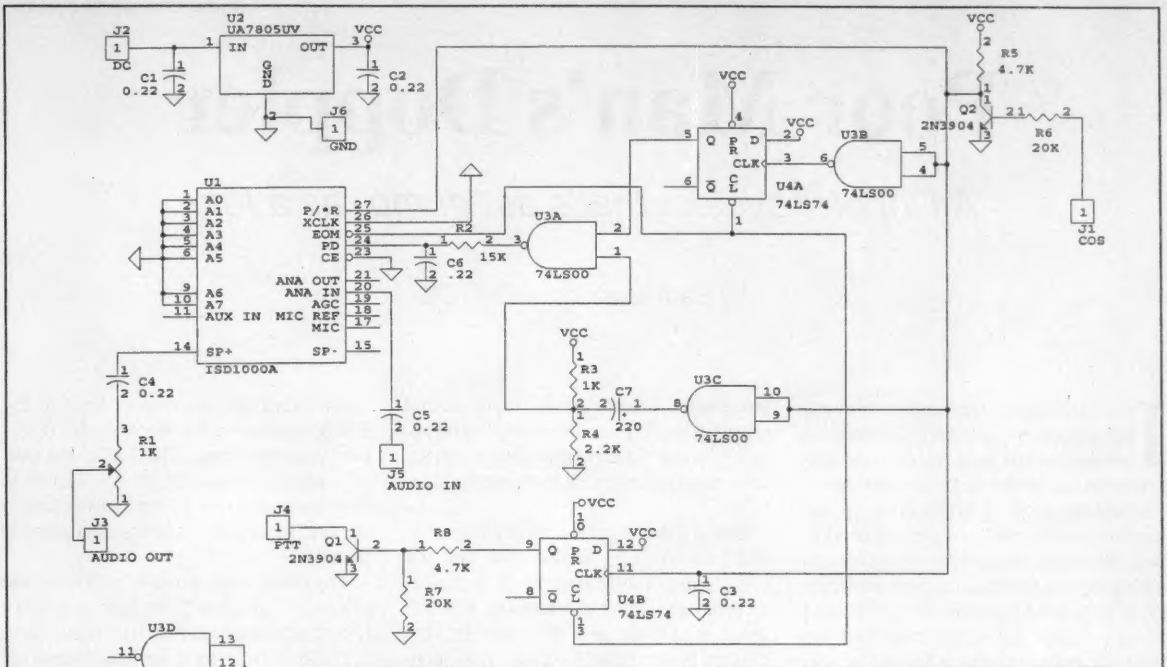
Resistors
(All fixed resistors are 1/4-watt, 5% units)
R1—1K ohm potentiometer
R2—15K ohm
R3—1K ohm
R4—2.2K ohm
R5, R8—4.7K ohm
R6, R7—20K ohm

Capacitors
C1, C2, C3, C4, C5, C6—0.22-µF capacitor (RS 272-1070)
C7—220-µF electrolytic capacitor (RS 272-1029)

Addittional Parts and Materials
Connectors, solder, breadboarding material, power supply

Point	Description
J1—COS	Connect to carrier-operated squelch of radio. Must provide >0.7 V if a carrier is present, and <0.7 V if no carrier is present.
J2—V_{CC}	Unregulated DC input from 7 to 12 V.
J3—Audio Out	Connect to audio input of radio and adjust R1 to suitable volume level.
J4—PTT	Connect to push-to-talk of radio to control transmitting. This point is grounded to key the transmitter.
J5—Audio In	Connect to audio output of radio. The input impedance of this point is 2.7k ohm and the maximum drive level is 50 mV p-p.
J6—GND	Connect to ground of the radio.

Table 1. Interfacing Information.



Notes: U1 — Pins 16 and 28 to V_{CC}; Pins 12 and 13 to GND U3 — Pin 14 to V_{CC}; Pin 7 to GND U4 — Pin 14 to V_{CC}; Pin 7 to GND

Figure 1. Schematic Diagram for the Simple Simplex Repeater.

put/output points are shown in Figure 1 for interfacing the Simple Simplex Repeater. Table 1 details the interfacing information needed for connecting the six input/output points to a radio. If your radio cannot be interfaced directly, a minimal amount of interfacing hardware is required to complete the interface.

Conclusion

The Simple Simplex Repeater is ready to be powered up and used! This inexpensive and easy-to-build project allows anyone to have a repeater readily available for emergency use.

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Poor Man's Doppler

A Doppler system that's as "dumb" as a fox.

by Sam Guccione K3BYCC

In recent years, transmitter hunting has grown in popularity. Transmitter hunting, or fox hunting as it is sometimes called, is the original amateur radio athletic sport. Searching for an unknown transmitter by using your skill with electronic equipment, coupled with navigational techniques and athletics (you may have to walk or run around some), makes for an exciting and fun time. *73* magazine has a column devoted just to fox hunting called "Homing In," edited by master hunter Joe Moell KØOV.

After reading Joe's book[1] and columns in *73*, I have learned that one of the better methods of transmitter hunting at VHF and UHF frequencies is the Doppler. In a Doppler system, four antennas in a square array are electronically switched on and off in a rotating sequence. The signal received at each antenna is processed to determine the direction or bearing of the signal arriving at the array. In the presence of a strong clear signal without surrounding obstructions, the Doppler gives a true bearing. A popular Doppler design, The Roanoke Doppler[2], gives bearings to less than 22.5 degrees with a 16-LED display. When obstructions are present, multipath can occur that causes the display bearing to fluctuate around the true bearing. Using eyeball averaging, you can usually determine a consistent bearing even in multipath situations.

One of the biggest disadvantages of Doppler systems is the cost and the complexity of construction of the antenna array switching mechanism. A much simpler and cheaper direction finding system is the Homing kind. Two techniques are used in Homing DF units to get a direction. They are the time difference of arrival (TDOA) method[3] and the phase front detector.[4] The methods are similar and produce essentially the same result. The TDOA uses two antennas that are electronically switched back and forth. The antenna that is closest to the signal transmitter is the one that picks up the arriving signal first. An LED connected to that antenna will light up when this occurs. By manually rotating the two antennas together as a pair, you can find a bearing point where the LED on the first antenna goes out and the LED on the second antenna lights up. Rotating the antennas back slightly will produce a cross-over point where neither LED is lit. This bearing angle, which is the broadside direction of the two antennas, is the exact bearing (to within a few degrees or less) to the fox transmitter referenced to the direction you are facing. The LEDs are usually marked left and right in a TDOA to indicate which side of the bearing line to the fox transmitter your antenna array is pointed.

The phase front detector processes the phase information from both antennas. If both antennas are exactly broadside to the signal bearing line, the phase for them will be the same and a null will be produced when they are compared. Rotating the antenna to the left or right will cause the phase to be different. This difference is sensed and displayed as a left indication or right indication.

The Homing DF units have the same problem with multipath as the Doppler. However, they are much cheaper and simpler to construct, including the antenna array, than the Doppler. After weighing the cost and construction complexity of these two methods, I chose to put a Homing DF system together. Not wanting to build a unit from scratch, I began looking for an inexpensive Homing DF kit. Fortunately, Ramsey Electronics had just such a kit: the "Fox Hound" Radio Direction Finder Kit Model DF-1. The DF-1 sells for $59.95, excluding a cabinet.

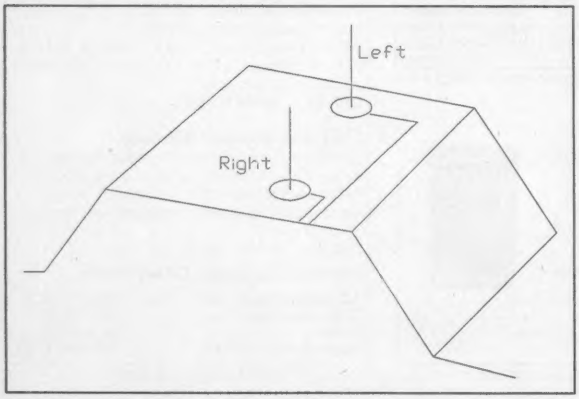

Figure 1. Left/right setup.

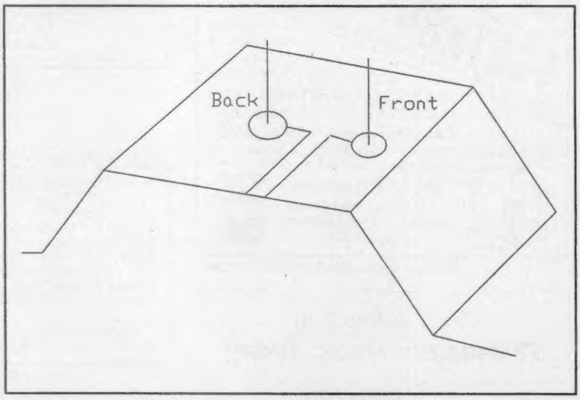

Figure 2. Front/back setup.

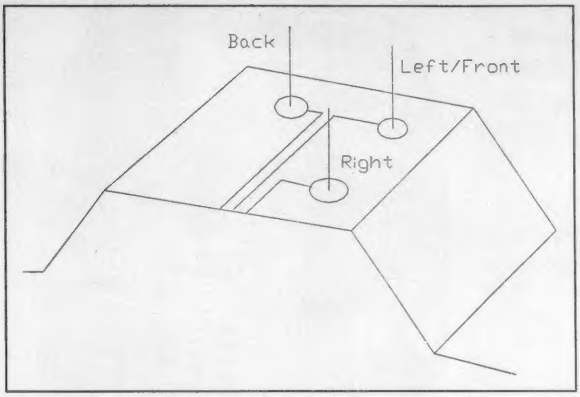
Back
Left/Front
Right

Figure 3. Triangular setup.

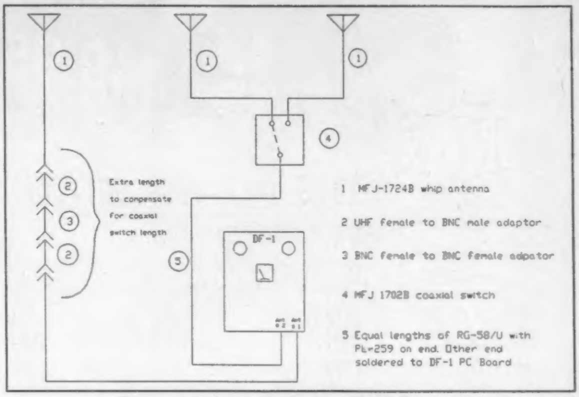
①
①
①
④
②
③
②
Extra length to compensate for coaxial switch length
⑤
DF-1
Ant #2
Ant #1
1 MFJ-1724B whip antenna
2 UHF female to BNC male adaptor
3 BNC female to BNC female adpator
4 MFJ 1702B coaxial switch
5 Equal lengths of RG-58/U with PL-259 on end. Other end soldered to DF-1 PC Board

Figure 4. Triangular setup wiring diagram.

Stationary System

I quickly ordered a DF-1 kit. While waiting for the kit to arrive, I searched through my *73* magazines for a review of this kit. KØOV reviewed[5] the original kit and found problems with its revision 1 PC board. Ramsey has since upgraded the PC board. I had no difficulty with assembly including the antenna system construction. My kit, which had a revision 2.3 PC board, worked correctly and as advertised. The left/right indication was easy to follow on foot, except when significant multipath was present. I used eyeball averaging in those situations to establish a left or right direction. Installing the DF-1 in my car consisted of mounting a pole temporarily attached to the inside of my driver's side door. The window had to be rolled down to be able to rotate the antenna manually. I did this work in the winter months of 1994. While using the Ramsey during an especially cold day of fox hunting, I began to wonder about mounting the two antennas in a fixed arrangement on my car so that I could fox hunt with the windows rolled up. The fixed left/right arrangement shown in Figure 1 produces a bearing that points toward the front of the car. The LEDs give a left/right indication with respect to the direction the car is traveling. I had remembered one of KØOV's "Homing In" columns that described a Homing DF system with fixed antennas used by CAP hunters.[6] In reviewing that column, I found the CAP hunters had used permanently mounted whips on their vehicle.

I looked the Ramsey unit over carefully to see if it could be modified for fixed antennas. The DF-1 antenna array consists of two vertical dipoles that are connected to the unit's PC board by two equal lengths of coax soldered directly to this board. This arrangement seemed to lend itself to easy modification.

Fixed-Antenna Modification

Before making the modifications, I looked at different kinds of whips that might be used. Cost was a factor. I quickly settled on the MFJ-1724B whip. This antenna is a dual band magnetic mount whip (hey, maybe I could make this work on 440 as well) with 15 feet of coax, a PL-259 connector attached, and a bonus: a female UHF to male BNC adaptor as well.

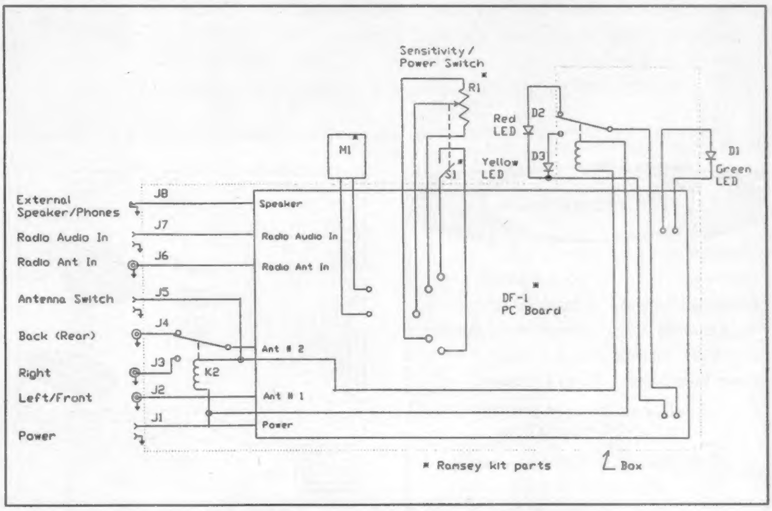
Sensitivity / Power Switch
R1
*
M1
*
S1
*
Red LED
D2
Yellow LED
D3
D1
Green LED
External Speaker/Phones
J8
Radio Audio In
J7
Radio Ant In
J6
Antenna Switch
J5
Back (Rear)
J4
Right
J3
K2
Left/Front
J2
Power
J1
Speaker
Radio Audio In
Radio Ant In
Ant # 2
Ant # 1
Power
DF-1 PC Board
*
* Ramsey kit parts
Box

Figure 5. Repackaged DF-1 wiring diagram.

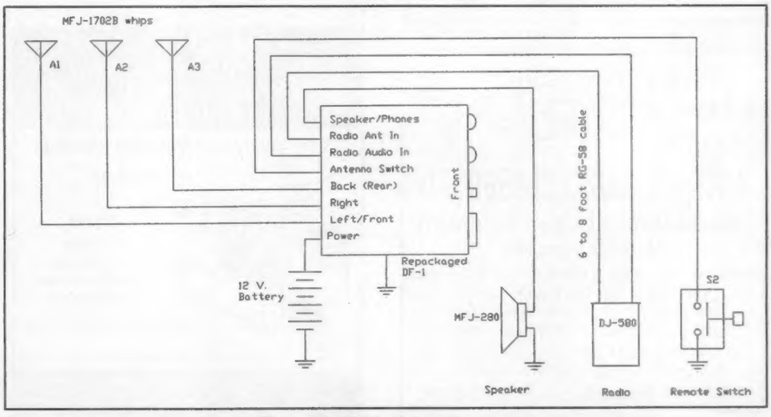
MFJ-1702B whips
A1
A2
A3
Speaker/Phones
Radio Ant In
Radio Audio In
Antenna Switch
Back (Rear)
Right
Left/Front
Power
Front
Repackaged DF-1
12 V. Battery
6 to 8 foot RG-58 cable
MFJ-280
DJ-580
S2
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Figure 6. PMD wiring diagram.

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MPB-15	2 x 6 x 2	4.40	5.00
MPB-16	2 x 8 x 2	6.65	7.35
MPB-17	3 x 2 x 3	2.45	2.95
MPB-18	3 x 4 x 3	2.90	3.50
MPB-19	3 x 6 x 3	4.20	4.90
MPB-20	3 x 8 x 3	4.65	5.45
MPB-21	4 x 6 x 3	4.55	5.15
MPB-22	4 x 10 x 3	4.75	5.45
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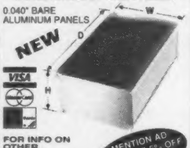

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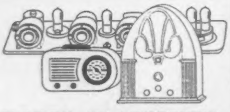

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Parts List

Item	Description	
A1,A2,A3	Antenna Whip	MFJ-1724B*
B1	Speaker	MFJ-280*
M1	Meter**	
PC	Ramsey "Fox Hound" Direction Finding Kit	DF-1**
R1/S1B0	100 k ohm potentiometer with switch**	
D1	Green LED	276-022***
D2	Red LED	276-041***
D3	Yellow LED	276-021***
J1	DC power jack	274-1563 ***
J2,J3,J4	SO-239 chassis mount jack	278-201***
J5,J7	Panel mount phono jack	274-852***
J6	BNC chassis mount jack	278-105***
J8	Subminiature panel mount phone jack	274-251***
K1	12-volt relay	275-241***
K2	SPDT RF relay Omron G5Y-1-DC12	Z724-ND****
S2	SPST momentary push button switch	275-1556***
Box	3 1/16" x 8 1/4" x 6 1/8"	270-274 ***
4- to 5-foot hookup wire		
2- to 3-foot RG-174 coax		
6- to 8-foot RG-58 jumper cable with BNCs		
3 snap-in LED holders		

* Available from MFJ
** Part of Ramsey DF-1 kit
*** Available from Radio Shack
**** Available from Digi-Key

To test the DF-1 with the MFJ whips, I removed the Ramsey antenna system and installed female BNC jacks to the PC board. I connected the MFJ whips to this modified board using the UHF to BNC adaptor supplied with the whip. I placed the whips on my car as shown in Figure 1. With this antenna configuration, the DF-1 LEDs indicate left/right directions. A lit left LED would indicate the fox transmitter was to the left of the direction in which I was driving. A lit right LED would indicate the fox transmitter was to the right of the direction in which I was traveling. If neither LED was lit, then I was travelling in the exact direction in which the fox transmitter was sending a signal. All I had to do to find a hidden transmitter was turn left or right, following the LEDs until I could line up my car on the exact bearing so that neither LED was lit. Unfortunately, this doesn't work in practice because highways and roads are seldom laid out to be in line with the signal direction of the hidden transmitters I was trying to find.

Front/back

While thinking about this problem, I tried moving the whips to a front/back setup shown in Figure 2. This worked just as well as the left/right setup.

In the front/back setup, I follow the LED connected to the front antenna until it goes out and the back LED lights up. I thus know that I have just crossed over a bearing line of the fox, and the transmitter is now behind me. I then make a right (or left) turn and note which LED is lit. If the back LED is still lit, I make a quick turn around and go the other direction; otherwise, I continue in this new direction. Once again, I follow the front LED. I repeat the above process until I am close enough to use my handheld with active attenuator or my sniffer unit.

Giving more thought to both the front/back and left/right setups, I decided to put four whips on the car and switch between the pairs. This would give me a four-direction indication. This setup is briefly described in Transmitter Hunting.[7] Two SPDT coaxial switches or a DPDT coaxial switch would be needed. Trying to keep this really simple, I figured that only three antennas and one SPDT coax switch could be used if I set up a triangular antenna array as shown in Figure 3. The whips were spaced about 18 inches apart—a quarter wave length. I used an MFJ-1702B coaxial switch to switch the right and back whips to form the left/right pair and the front/back pair. One whip functions as the left/front antenna. The wiring diagram for this configuration is shown in Figure 4. Several fox hunts confirmed that this system worked well except that the same pair of LEDs that indicated left/right were used for front/back. I got confused a few times because of this.

At this point, I decided to repackage the DF-1 to have separate pairs of LEDs for left/right and front/back, electrically switched antennas with the switch near the steering wheel, and a low profile so that it would sit on the dash just behind the steering wheel. I would not have to look down to see which LED was on and which position the coax switch was in. Even though this system does not work on the Doppler principle, I call this "A Poor Man's Doppler" because it is relatively cheap, easy to construct including the antenna array, uses a multiple antenna array sort of like a Doppler, and gives bearing directions in one of four directions using LEDs.

Poor Man's Doppler Construction

I recommend building the DF-1 according to the instructions supplied by

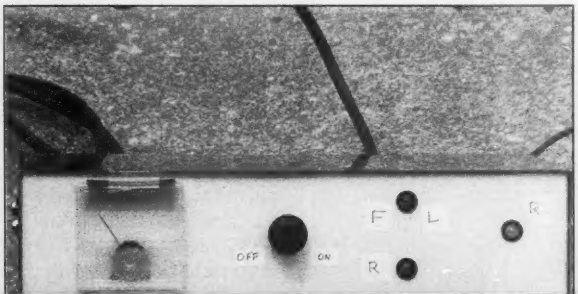

Photo A. Front view of PMD (all photographs courtesy of N3JGP).

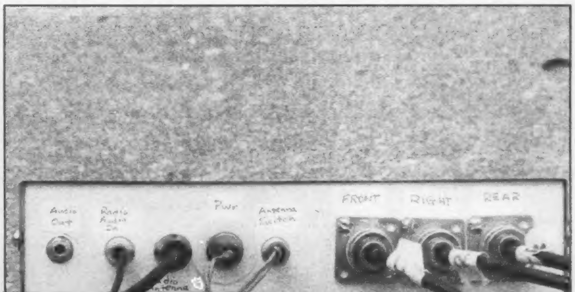

Photo B. Rear view of PMD.

Ramsey and testing it for correct operation before constructing a PMD. Figure 5 shows the wiring diagram of the repackaged DF-1, and Figure 6 shows the complete Poor Man's Doppler system wiring diagram. Table 1 shows the parts list. The three MFJ whips are used unmodified. I used a 6- to 8-foot jumper cable of RG-58 with BNC connectors to connect my handheld to the Antenna Input of the PMD. Also, I decided to use an external speaker, an MFJ-280, instead of building this into the box. I used manual electrical switching instead of automatic electronic switching so that I could choose to follow the front/back or left/right directions. The system is in the front/back mode until I push the remote switch button.

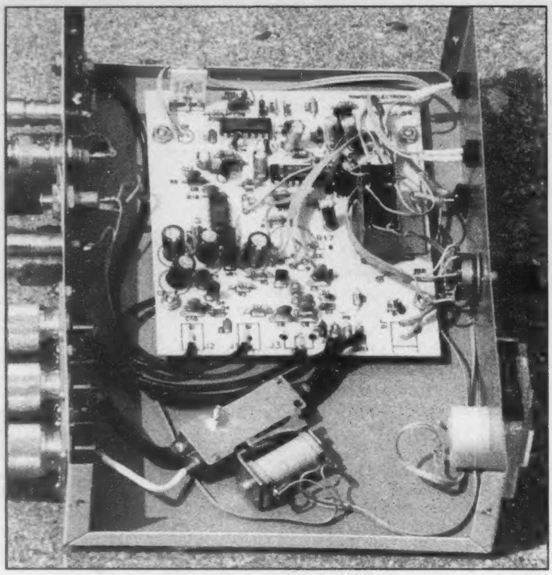

Photo C. Interior view of PMD.

The construction is straightforward. The only critical area is the coax cable lengths from the PC board antenna connections to the SO-239 antenna jacks. Use equal lengths of RG-174 from the RF relay K2 to jacks J3 and J4. Any length may be used from the relay to the antenna 2 input on the PC board. However, the length of RG-174 from J2 to antenna 1 input must be the same length as from J3 or J4 to antenna 2 input. Be sure to add a little bit for the length in the RF relay K2.

Photo A shows the front view of the PMD. I ended up using only three LEDs: a green one for the front/left direction, a red one for the back direction, and a yellow one for right. The bottom LED marked R in Photo A is the Red Rear or Back LED. The meter and sensitivity control/power switch are existing parts of the Ramsey kit. Photo B shows the rear view of my repackaged DF-1. The SO-239 marked Rear is the Back antenna input. Photo C shows the interior view of the repackaged DF-1. The DF-1 PC board is mounted on standoffs. The large object at the bottom of the box is a surplus coaxial relay that has been replaced by the Omron RF relay. The SPDT relay used to switch the LEDs is hot glued to the middle right side of the PC board. Photo D shows the three whip antennas in place on the author's car. The PMD box can just be seen behind the steering wheel. The barely visible string attached to the front/left antenna is used to set the correct spacing when placing the whips on the car roof.

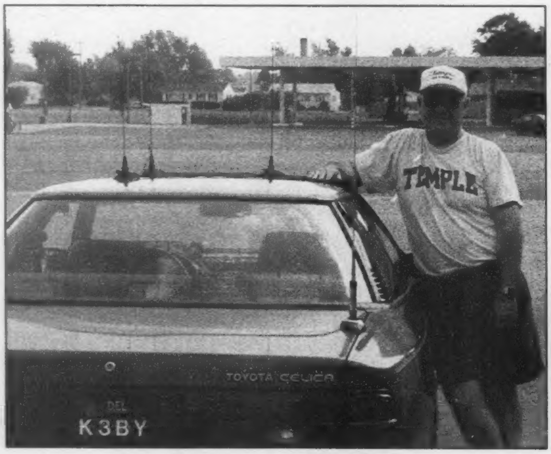

Photo D. PMD mounted on author's car.

Using the PMD

This is my technique for using the PMD. I get an initial compass bearing using a three-element beam and my handheld. I begin driving in the direction of the compass bearing using a dash-mounted car compass. I watch the front and back LEDs. Quite often they are alternately flashing, indicating multipath. I eyeball average to determine which LED is on most of the time, and try to keep the car heading in a direction so that the front (green) LED is mostly on. I periodically switch to the left/right to see which side the fox transmitter is located with respect to the track I am traveling.

I continue driving until the back (red) LED turns on. When this occurs, I know I have crossed over the bearing line of the transmitter signal. I quickly switch to the left/right antennas to see on which side of the car the signal is located. I turn in the direction indicated by which LED is lit, the left or right. I once again follow the front LED. I continue the above process until my sniffer, which I connect to an antenna before starting a hunt, sounds off.

440 Operation

Once I got the PMD working to my satisfaction on 2 meters, it was time to see if it would work on 440 MHz. My initial tests showed erratic indications. I decided the spacing needed to be much closer than 18 inches. Since a quarter-wavelength spacing is usually recommended for Homing DF units, I changed the antenna spacing to 6 inches and tried again. This produced mixed results. My next try was to replace the dual-band whip elements themselves with quarter-wave whip elements cut for 440 MHz. I constructed the 440 whip elements from 1-inch-long 3/8 x 24 bolts and 7-inch lengths of brass welding rod. I drilled a 1/4- to 1/2-inch deep hole in the top of each bolt to accept the welding rods, and soldered the rods in place. I replaced the dual band elements with the homemade 440 elements. An MFJ-219 440-MHz SWR meter was used to set the length to the resonant frequency that I wanted. I ended up with a length of 6-3/16 inches.

The unit immediately began to work except that the LED direction indications were completely reversed. That is, a fox transmitter on the left side of the car was causing the right LED to light. Similarly, a fox transmitter in front of the car caused the back LED to light. A 180 degree phase reversal had taken place. No provision is made in the DF-1 to compensate for phase reversal other than to reverse the antenna locations.

I reviewed the DF-1

schematic. The two phase signals that cause the LEDs to light are applied to the inputs of a quad XNOR chip. Reversing these two signals to the inputs of the XNOR should reverse the LED display. However, I have not tried this combination.

For the time being, I decided to use only two antennas on 440 and physically reverse their locations. I presently use the front/back pair that are swapped so that the back antenna is placed to the front of the car and the front antenna is placed in the rear. This swapping achieves a 180-degree phase shift that compensates for the 180-degree phase shift that occurs in the PMD. I hunt in this mode using the procedure I described in the front/back section. I have found that this is not as good nor as convenient as the full PMD, but it has allowed me to participate in 440 hunts. I plan to work on a phase switch of the signals sometime in the future. However, because I am having fun playing and using this present setup, these changes will have to wait for this coming winter.

Conclusion

Although the PMD does not give an exact bearing to the fox transmitter as does the Doppler, I have found it to be competitive in comparison to them and cheaper. Parts are readily available and construction is relatively easy. Let me know if you build one of these. I can be reached at sguccion@outland.dtcc.edu, on the fox-list USENET group.

References

1. Joseph Moell and Thomas Curlee, *Transmitter Hunting: Radio Direction Finding Simplified,* (TAB Books, 1987).
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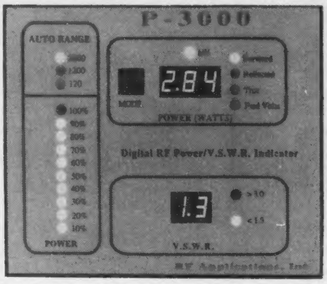

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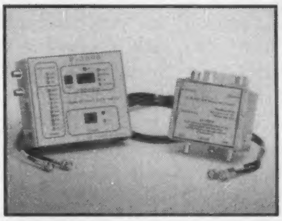

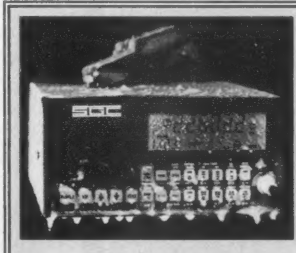

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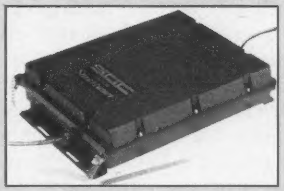

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CIRCLE 384 ON READER SERVICE CARD

A Serial Port CW Terminal, or ROBO-COPY Revisited

Cure the itch for computer CW.

by Mike Aiello N2HTT

I have always had ambivalent feelings about the code. Its efficiency and simplicity are powerfully attractive, but my own lack of copying skill was frustrating. So when I saw Michael Hansen's article in *73* about his ROBO-COPY CW copier[1], I instantly knew this was a project I had to build. I was delighted with ROBO's performance. The simple audio interface and IBM-compatible software completely lived up to my expectations.

Human nature being what it is, however, it wasn't long before I began to feel the need for a fully functional CW terminal that could run on my PC. So, with the addition of transmitter-keying hardware and completely new software, the project evolved into a bidirectional serial port CW terminal, which I call the Serial CW Terminal, or SCW.

Keying Hardware

The standard PC RS-232 interface makes use of a UART (Universal Asynchronous Receiver/Transmitter) chip of the 8250/16450/16550 family. These chips allow software control of two output lines called DTR and RTS, either one of which could be used to key a transmitter for sending CW. Under software control, these lines may be asserted (set to a logical ON state) or dropped (set to logical OFF). My original thought was to toggle one of these lines connected through an opto-coupler to operate a simple keying circuit. The opto-coupler would provide good isolation between the expensive PC and whatever junk box components I used in the keyer. As it turned out, this simple solution was unworkable because of an unexpected problem.

The PC controls the UART's output lines by setting a register located on the UART chip. Once that register is set, it will retain its setting until the PC writes to it again or is shut down. Many common communication programs (serial mouse drivers, for example) assert the very lines I was considering for my keyer. Once set, they remain asserted after the software has finished executing on the PC. So there was a very good chance that the keyer circuit would see the serial port line asserted and go key down immediately as power was applied. This was an unacceptable flaw in the scheme, but happily there is a straightforward solution based on two facts:

1. Software that uses hardware handshaking (the serial port output lines) generally asserts two of the lines simultaneously: DTR and RTS.

2. Logic states on the RS-232 lines are represented as voltages of opposite polarity, roughly +/-9 volts.

In the keyer circuit shown in Figure 1, I arranged two opto-couplers with their outputs in series and their inputs connected with opposite polarity in regard to signal ground. With DTR connected to the positively oriented opto-coupler, and RTS to the negatively oriented, the output side will only conduct to ground when DTR is asserted and RTS is dropped. This configuration forms a "logic gate" that will key the transmitter only when the DTR high/RTS low combination is presented to it. A "truth table" for this circuit would look like this:

Transmitter Keying Based on RTS/DTR Logic States

	DTR ASSERTED	DTR DROPPED
RTS ASSERTED	UNKEYED	UNKEYED
RTS DROPPED	KEYED	UNKEYED

The normal rest state of the UART, where both lines are dropped, and the software-induced state, where both lines are asserted, are safe, as is the DTR low/RTS high combination (which I do not believe occurs in nature).

As neatly as all this worked out, in actual practice it proved not to be the whole solution. If I left the interface connected to the PC while it was booting, the mouse driver apparently cycled through the RTS-OFF DTR-ON condition, briefly keying the rig! The position of the power switch had no effect, since the keyer side of the circuit draws its power from the RS-232 lines and not the battery in the interface.

I wound up replacing the SPST power switch in the original interface with a DPDT. Half of this switch controls power to the receive side, and the other half, as shown in the circuit diagram, interrupts the output side of the keyer. With this modification, there is no way the PC can key the rig when the power switch is in the off position.

The resistors shown in the circuit are current limiters for the LED side of the opto-couplers. Signal diodes were added to combat one other problem: The opto-couplers I was able to obtain were only rated for a peak inverse voltage of 3 volts on the LED side. Since this is much less than the typical 9-volt swings of the RS-232 lines, I added the 1N914s. They have a PIV of about 60 volts and protect the opto-coupler's input. The output transistor in the 4N26 opto-coupler can sink about 300 mA. Solid-state rigs that use direct keying don't require any additional circuitry. In a situation where a higher current or voltage is present on the transmitter's key line, or if your rig requires grid block keying, the appropriate relay or pass transistor could be added after the opto-coupler output.

Construction Techniques

As you can see from Photo A, the construction and parts layout are not terribly critical. In my prototype I used "dead bug" construction on one side of a piece of double-clad circuit board with excellent results. There is one thing to keep an eye on, though: the matter of grounds. There are four different circuit grounds that meet at the hardware interface: the signal and braid grounds of the RS-232 connection; the ground side of the audio in; and the ground side of the transmitter key line. In order to minimize noise, interference, and potential ground loops, all of these grounds are isolated in the interface. If you look closely at the photograph, you may be able to see where I cut gaps in the foil to isolate the circuit ground plane from the metal box (look where the screws go through the board at the corners). Less obvious is the use of insulated binding posts for the key line to the transmitter; both sides are isolated from the box. It is of particular importance that the only ground to be connected to the circuit itself is the signal ground from the RS-232 line (pin 7 of the 25-pin connector, or pin 5 of the 9-pin connector.)

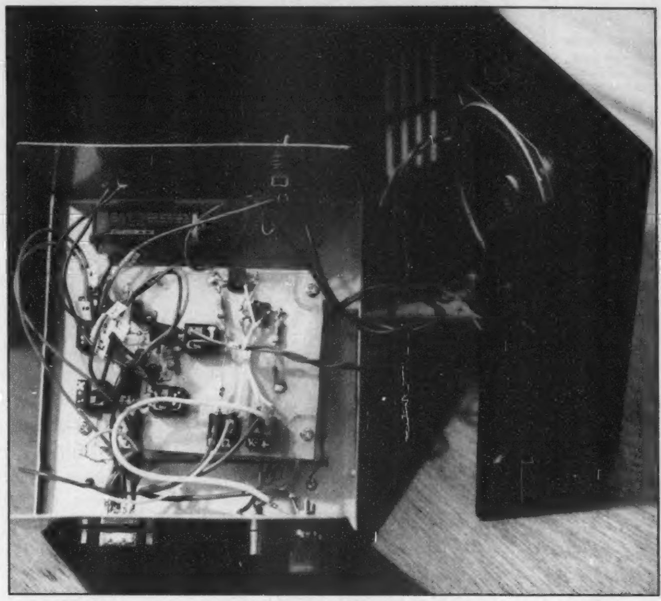

Photo A. The serial port CW terminal.

SCW Software

SCW is a completely new software package that provides receive-only capability with unmodified ROBO-COPY interfaces, and is a full featured bidirectional CW terminal with the addition of the keyer circuit described above. Although SCW offers some of the same user features as ROBO-COPY, its internal architecture is different and this allows for some intriguing extended capabilities.

Like ROBO-COPY, SCW uses the UART to provide the basic timing of the CW send and receive, thus making it usable on machines of any speed and vintage in the IBM-compatible family, from 8088s to 486s.

SCW's receive logic differs from ROBO-COPY in that the decoding algorithm is not statistical in nature, but rather makes use of heuristics or decision rules to accomplish the decoding. The most noticeable consequence of this difference is the lack of any user-adjustable CW timing parameters; they are not needed. Like ROBO-COPY, SCW does offer a noise filter feature that is user adjustable. This feature requires audio tones to persist for a certain minimum duration before SCW accepts them as Morse dits or dahs. As the minimum pulse width is increased, the system becomes more noise immune, but the maximum code speed that can be decoded is reduced.

Program Feature

SCW provides a split-screen user interface that displays received text in its upper portion, and transmitted text in the lower. The upper window displays the complete set of Morse characters, including prosigns. You may elect to have SCW display prosigns as character pairs in reverse video, or as special characters. Dot-dash combinations that SCW does not recognize are displayed as the tilde character (~).

The lower window is also shared by the program help screen and several user dialogs. The bottom of the screen displays the current program status, and a function key prompt bar. In the default mode transmitted text may be entered and edited while the program is receiving, and is sent only when the return key is pressed.

SCW allows full break-in operation (QSK, or full duplex); however, if your rig produces an audio side tone that cannot be switched off, you can suppress receive during send to avoid echoing your transmitted code in the receive window.

You can control most of the important program functions with the function keys. Repeated presses of the F8 key cycle the send function through buffered mode, direct mode, and complete shut-off. F9 toggles the receive function on and off. Many less frequently used program functions are activated via ALT key combinations, and pressing F1 displays a concise summary of all the keys SCW recognizes.

Two very handy features included in SCW are file capture and the ability to define keystroke-send macros. File cap-

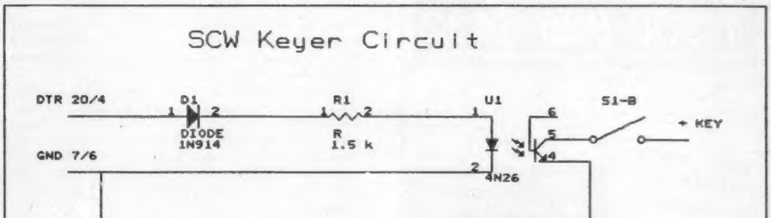

Figure 1. SCW keyer circuit.

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CIRCLE 193 ON READER SERVICE CARD

ture may be turned on or off at any time and captures the received text into an ASCII text file. The macro feature allows you to create one macro of up to 255 characters in length for each of the ALT-number keys. You can create or edit macros at any time, and by pressing the ALT-number key you can add the macro's text to the current send window.

Perhaps the most intriguing feature of SCW is its self-synchronizing ability. SCW can detect when it has lost its lock on an incoming CW signal. When this occurs, SCW displays a graphic character—a gray box the height of the line—to indicate that it is resynchronizing. Within a few characters SCW will once again be locked in on the signal. There are several things that can cause a loss of synchronization; QSB and isolated static or noise bursts are the most common. SCW fares least well in heavy QRM conditions, as it cannot distinguish signals by their audio pitch.

Availability

SCW is available at no charge for noncommercial use directly from me via mail for $5.00 to cover the cost of diskette, packaging, and postage. The SCW package includes the SCW terminal program (which can run using COM1 or COM2) and a brief documentation file, packaged together in a self-extracting compressed file.

I'd like to thank Michael Hansen WB9DYI for his excellent work in developing the ROBO-COPY interface, without which I would never have undertaken this project, and my good friends Matty Mozzor N2IMZ and Gordon Horn W2WTV for their encouragement and insightful critiques of the SCW software. Special thanks also to Dan Iancu for his invaluable help with the keying circuit.

Mike Aiello N2HTT, Box 195, Pleasantville, NY 10570.

References

1. Michael Hansen, "ROBO-COPY," *73 Amateur Radio Today,* October 1990, p28.

2. SCW software available on 3 1/2" diskette from Cortlandt Technologies, P.O. Box 195, Pleasantville NY 10570, for $5.00 postpaid.

Parts List

R1, R2	1.5k-ohm resistors
D1, D2	1N914 signal diodes
U1, U2	4N26 phototransistor opto-couplers
S1b	one side of DPST switch

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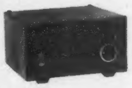
MODEL	Colors Gray	 Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

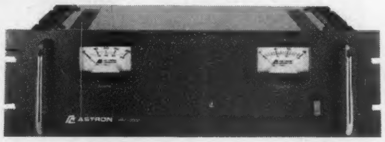
RS-L SERIES



- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



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MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	 Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

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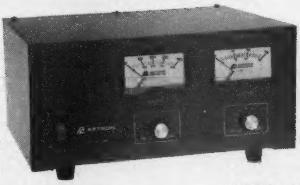

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- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	 @10VDC	 @5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Colors Gray	 Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

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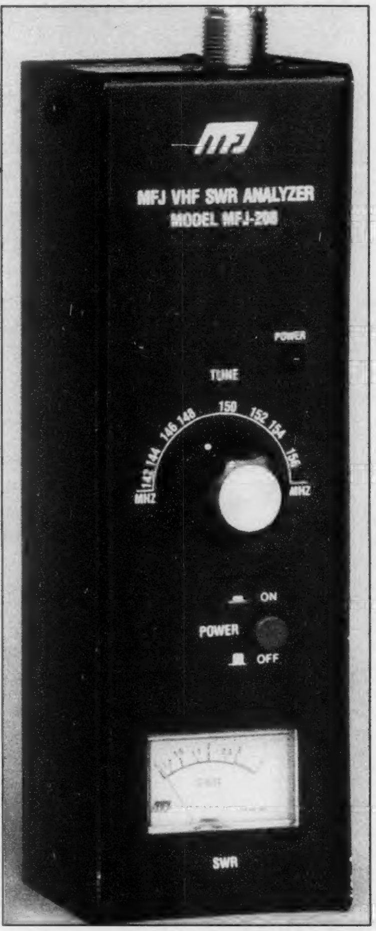

I like test equipment. No, let me rephrase that—I am obsessed with test equipment. I want one of everything. Ask my wife; she will tell you. My collection started 40 years ago with a Heath meter; and now I have a shop full of everything. Anyway, the MFJ-208 2 meter SWR Analyzer™ is now part of my collection. I was a little skeptical at first due to the price of the unit, but I might as well tell you right now that the unit works and performs very well.

Your days of using your HT or base station rig running through an SWR bridge of questionable VHF performance into an unknown and sometimes hostile load are over. Admit it! How many times have you taken that CB SWR bridge and tried to use it on two meters? With the newer radios, if the antenna load under test isn't reasonable and close to 50 ohms when you first start testing, then the radio starts to shut down so you don't know where you are. Solution: just hook up this MFJ Analyzer and let it be your transmitter and SWR bridge combined. Just let her rip—no strain on your equipment, and you get the job done without hauling all that stuff out to the back yard.

Bench testing and a peek inside

As I passed through the kitchen with the analyzer on the way down to my shop, my wife asked me what the small box was. I told her it was spare parts—that always works. Safely downstairs in my shop, I removed the sheet metal screws, opened the unit up, and installed the 9-volt battery. I then pushed the switch and got a red LED. Carefully tuning the analyzer across the two meter band produced a strange buzzing sound from a nearby receiver. Yes, it's working, or at least it's oscillating on the two-meter band, I thought. A quick check on a dummy load confirmed it. I got a nominal SWR. Well, that figures. I checked one of my two meter beams and it showed some reflected power, but very little.

The unit uses a double-sided printed circuit board with professional traces. Attached to the board are the air variable capacitor and the meter. An LM324 operational amplifier IC was mounted in a socket for easy replacement, if necessary. The unit can be powered by a single 9-volt battery, or the MFJ-1312 power supply adapter. When installing the 9-volt battery, the manual cautions you to tuck the battery snap wires out of the way so that they do not interfere with the tuning capacitor rotation. This capacitor is a pretty good size air variable with moving plates mounted to a shaft, so heed their caution.

Checking the current drain from the 9-volt battery, I found that it was only 45 milliamps. The unit displayed a clean signal on my spectrum analyzer, and an output level of approximately 3 milliwatts. With this much output, MFJ cautions that damage to some radios may occur with a direct connection. In other words, don't hook this analyzer up directly to your HT. Moreover, don't transmit into the analyzer. I hooked the analyzer up to an external antenna to see if I could hit a nearby repeater. Buzz-kerchunk, no problem, as I carefully tuned through the repeater input. I then identified my mysterious transmission using my shop radio.

As MFJ does not supply a schematic, I wrote Stan Kozlowitz AA5XO at MFJ and asked him for a diagram. He promptly sent it to me but asked me not to publish it. Basically, the circuit is a VHF oscillator modulated by a low-frequency tone of approximately 170 Hz. Measuring the FM deviation on the service monitor in the FM mode resulted in a total deviation of approximately 12 Hz, so it will really buzz your receiver. According to Stan, the oscillator of the analyzer feeds a very sensitive Wheatstone bridge with a meter across the bridge. MFJ has an operational amplifier in the circuit to improve the sensitivity of the meter and they use an op-amp circuit across the output to measure the voltage to determine resistance.

The manual states that the unit will cover from 142 to 156 MHz. In addition, MFJ states that the dial calibration is approximate. On the unit I tested I found the calibration to be very close when the knob was centered underneath the dial frequency numbers, which were every 2 MHz. The unit actually transmitted from 137 MHz to 157.9 MHz. During my testing I performed actual SWR checks in the 2 meter band and at 151 MHz. MFJ provides an RCA phono jack on the unit so that you can connect the unit to a frequency counter. I had no problems in driving any of my counters, including some of my older equipment.

I then made some test resistor loads using a 47-ohm, a 100-ohm, and a 150-ohm resistor. The SWR measurements made with the analyzer were plenty close enough for amateur use.

Backyard Testing

Testing the unit in my backyard antenna range produced immediate results and was very enjoyable. Tuning up a home-brew four-element quad with a gamma match was a snap. I just wiggled the adjustments on the gamma match and then stood back and measured the SWR. When I got to a minimum reading, I quit. I didn't have a frequency counter handy, so I used my handheld as a reference. Since the tuning on the analyzer is very sensitive, it is very hard to arrive at the exact frequency when using an HT. As you sweep through the target frequency, the S-meter will respond, even if you don't hear the signal. If you get a response on the S-meter, you are probably close enough. I also used the analyzer as a signal generator and stuck it out in a field. Due to the high output power, I used a small resistor load as an antenna. I then rotated my test antenna and watched the S-meter on my receiver to check for front-to-back ratio. It's a great little signal generator for testing your antennas.

I Was Hooked

After testing my quad, I then tested several commercial 5/8-wave antennas on my car. I then trimmed a mag mount 5/8-wave and a quarter-wave. Great!—this process is fast. I pulled down a couple of my commercial beams and touched them up. I am really getting the SWR fever now. Got to get those SWRs down on everything. On one job I took the analyzer up the tower and hooked it directly to a commercial antenna that was on 151 MHz. This provided a quick check of the antenna.

MFJ manufactures a commercial version of the analyzer that covers 150 to 170 MHz, and they also have other units including a 30 to 50 MHz model which I hope will cover the bottom end of six meters.

Testing Techniques

Next, I put together a quick 3-element home-brew beam with fixed capacitance coupling to be used for foxhunting. The only tuning was by trimming the driven element. Tuning the driven element on this beam was quick and easy using the analyzer. It only took about 5 minutes. MFJ mentions in their manual that when you are testing a new antenna, you should start with the driven element a little too long and then shorten it to resonance.

The MFJ manual includes a nice frequency vs. SWR chart for plotting your antenna response curve to show your buddies.

Then, I made a loop antenna for two meter foxhunting. If you have ever tried to tune one of these up you know how difficult it can be. I hooked up the analyzer, tweaked the variable capacitor on the loop antenna for minimum SWR and tested the antenna. It worked and had a nice null with good side lobes.

Overall, I liked the unit, and I liked the price and the construction. It's self-contained and easy to use. It will encourage you to experiment with home-brew antenna projects and to touch up your store-bought commercial beams. You no longer need to haul all that testing stuff out to the backyard. Just grab the "box" and start testing. Have fun.

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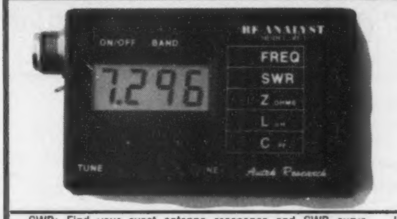

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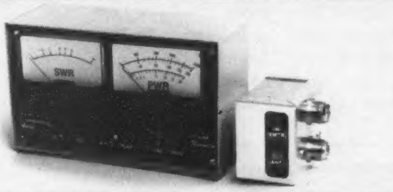

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73 Review

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by Gordon West WB6NOA

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Alinco DX-70 HF/6m Transceiver Surprises Everyone

Elegant and wide functioning with many conveniences for a good price.

Alinco Electronics, Inc., located in Torrance, California, is best known for its single- and dual-band VHF/UHF handheld and mobile transceiver equipment, sold by over 80 amateur radio dealers throughout the United States. Certain Alinco radios have achieved "fan club" status because of their unique design and relatively low cost.

Some Alinco Products

For instance, there are the Alinco 1200TH2 9,600 baud packet radio made popular by Buck Rogers packet column; the Alinco DJ-G1T, the first handheld ever with spectral channel-occupancy bar graph; and the Alinco DR-599 dual-band mobile with "secret" antenna jack for public safety 800–950 MHz.

While Alinco Electronics, Inc., does not possess the sales volume and market share that Kenwood, Yaesu, and ICOM have, the company does enjoy a reputation for well-performing VHF/ UHF equipment at prices slightly lower than the big three, and a small but efficient service team who can turn around most repairs at the Torrance facility within 10 working days. Alinco's technician/engineer Taka Nakayama AB6VE, is extremely active on the ham bands, and knows the equipment inside and out. "I love operating ham radio," comments Taka. "When it comes to 9,600 baud packet, cross-band duplexing, or driving in downtown areas where intermodulation is a problem, I know how well our Alinco radios work because I'm active on the air," says Nakayama with a smile. He holds an Extra class United States amateur license and a Japanese license, too.

ALINCO
HF TRANSCEIVER DX-70
AF
RIT
SQL
VFO M+V
MEMO MW
SPLIT PRIO
14.179
MULTI FUNCTION
MODE
SSB
CW
AM/FM
NB
AGC
TUNE
RF
FILTER
H/L
POWER
DIAL LOCK
ALINCO
TX TUNE
ANT TUNE
BAND
PWR SWR
1.8
3.5
7
10
14
18
21
24
28
THF
ANTENNA TUNER
EDX-1

Photo A. The Alinco DX-70 and the matching Alinco Antenna Tuner combine to form a compact "field" radio.

But Alinco Electronics really surprised the amateur radio community by coming out with a high-frequency transceiver for the 1995 Dayton HamVention debut. "First we have VHF/UHF, and now we have high frequency, too," comments Alinco Electronics USA President Mark Morisato KC6OCX. "And our new high-frequency DX-70 does more!" adds Morisato. No doubt Mark is speaking of the built-in, all-mode, 6 meter, 50–54 MHz capabilities with 10 watts output that is included in the high-frequency package and is the same size as the very popular and successful Kenwood TS-50 mobile HF transceiver.

DX-70 Features

The new Alinco DX-70 HF plus 50 MHz all-mode transceiver runs 100 watts out from 1.8 MHz to 28 MHz on ham bands, and tunes 150 kHz to 30 MHz continuously from its excellent general coverage receiver. Plus, it covers 50–54 MHz, with all modes, and 10 watts out. That's plenty of soup to kick a 6 meter power amplifier into "QRO".

Most unique is the detachable control head that allows the new Alinco DX-70 to be separated so the head could go on the dash, and the transceiver under the seat. The mike still plugs into the transceiver body, so separating the two won't be a trunk-and-dash affair. But I don't recommend trunk mounting of any remote-control transceiver because of the long run of the DC power cable. This is just asking for trouble. If you want a longer mike cord, they have an EDS-5 microphone extension cable that will handle the job nicely. Keep in mind that the extension cable will cost extra—probably about $40—so if you plan to run it remote, factor this in to the transceiver's street price, which will probably be around $1,250.

Yes, 6 meter fans, there is a separate output SO-239 antenna jack. When you switch to the 6 meter mode, you can hear several relays "go klink," which sound tells you they are running an independent receiver and transmitter section for best performance on the 6 meter band.

I hooked the DX-70 to a three-element HF beam and regulated 12-volt power source, with the 6 meter side over to a three-element 6 meter beam to see how the radio would perform in the real world. The display popped up with a bold numerical readout of frequency: MHz, kHz, and hundredths. The numbers are slightly smaller than the Kenwood TS-50, but are much bolder, wider, and darker. And like the Kenwood TS-50, there is a "busy" icon when the squelch is open, along with an amber jewel LED that also lights up with receive activity. The mode indicator appears in the upper right-hand corner, and AGC fast or slow appears above the frequency display. Finally, the DX-70 has more than enough to drive the top-mounted speaker.

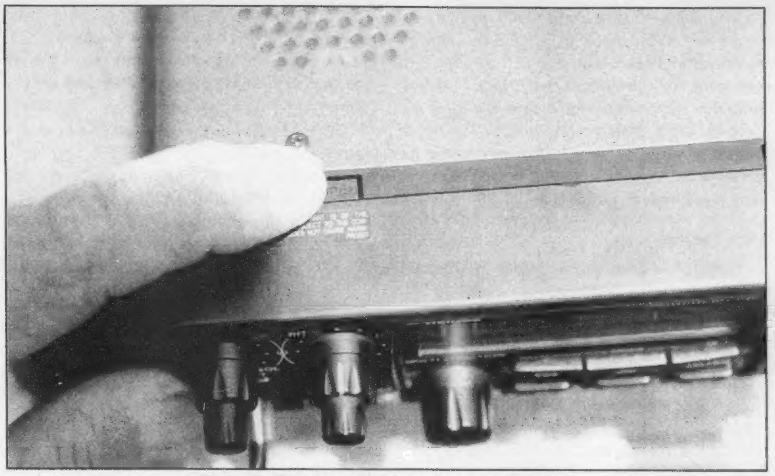

Photo B. Two "open" sliders clamp on the head.

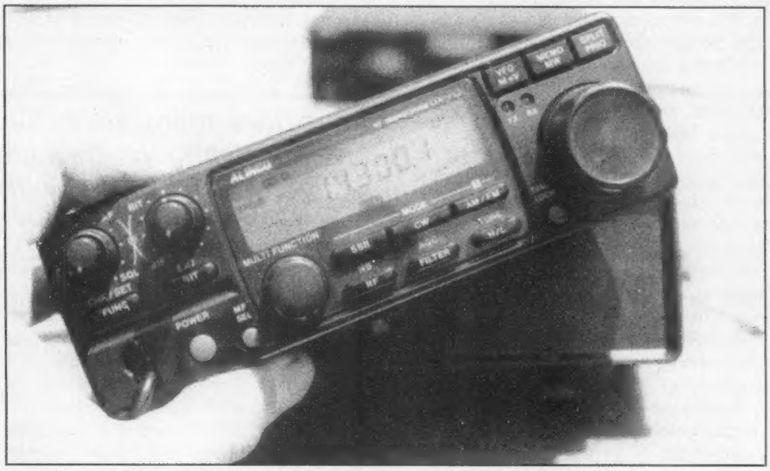

Photo C. The head detaches in 3 seconds for purposes of security.

The Receiver

As soon as I hooked into the three-element tribander, there was no mistaking that the Alinco DX-70 has a wonderful receiver. It is dual conversion, with sensitivity and selectivity numbers identical to what you might find on everyone's sales brochures for a $1,000 HF mobile SSB transceiver. But unique with the Alinco DX-70 is the bottom left RF button that lets you switch in the 10 dB pre-amp, switch it out, or switch in -10 dB and -20 dB attenuation. I found that the attenuator was a big help when operating on 40 meters, with a neighbor one block away just 75 kHz up the band. On 10 and 15 meters I switched the pre-amp on, which gave me a hot receiver.

The same button that controls the RF gain selection also has a subfunction: it turns the noise blanker on and off. While the noise blanker does not have any timing or sensitivity adjustments, it did a nice job of killing the clatter of our next door neighbor's old Ford Thunderbird when he fired up the engine. Furthermore, the noise blanker did not garble on extremely strong signals. On many HF transceivers, engaging the noise blanker on 40 and 80 meters causes most signals over S9 to become garbled. Not so with this noise blanker.

> ***"As soon as I hooked into the three-element tribander, there was no mistaking that the Alinco DX-70 has a wonderful receiver."***

Selectivity on SSB is 2.4 kHz, and a convenient "filter" button next to the RF gain button allows you to kick in the 1-kHz SSB filter. The 1-kHz filter is already built in, and not an added option for tightening up on an incoming weak signal. You can further home in on an elusive signal by rotating the IF shift knob to dodge the QRM. This same filter network offers 1-kHz or 1/2-kHz CW passband. And if you're into shortwave listening, you can click in 2.4 kHz AM narrow, or 9 kHz AM wide—including FM—for full fidelity reception.

The first IF is at 71.75 MHz, the second IF at 455 kHz, and spurious/image rejection is listed as 70 dB. When I switched back and forth between several transceivers on the bench, the Alinco was more sensitive and just as selective as the higher-priced sets.

Everyone commented on the recovered audio on SSB as being "sharp." It's the same-sounding audio I have heard from the Yaesu 900: impressive, full-fidelity treble without tightness or hiss. Listening to the DX-70, when tuned into a transmitting SSB station, is similar to hearing a hi-fi with bass, mid-range, and tweeters as opposed to an audio system with just a mid-range speaker. It's difficult to describe; try to listen for yourself.

The AGC is a function/AGC command on the same push button as the filter switch. The function button is conveniently located to the left of the set, a natural arrangement for depressing it with your thumb, while using your forefinger for the other button.

I switched up to 6 meters to confirm that all filters, noise blankers, AGC actions, and preamps weren't the same. I did notice on a big 6 meter antenna that 10 dB of pre-amp gain brought in a phantom sound of an FM or TV station way in the background that could never be tuned in, but didn't have that problem with the pre-amp turned on when we tested the unit on the mobile 54-inch whip.

I also tested the Alinco 6 meter receiver performance against two other time-tested rigs and found the Alinco actually hotter on receive with the pre-amp clicked on than the other two units, which were running with external amplifiers. And since the other two ran only 10 watts out, I didn't find 10 watts from this Alinco to be out of line. Mirage, now sold by MFJ, offers a 10-watt in, 150-watt output, 6 meter amp that I've seen selling for under $350, so getting more power from the Alinco package is not all that difficult.

Fine Tuning

The front panel of the Alinco features a main tuning dial along with a smaller tuning dial. The smaller dial is rotated for both memory channel select and megahertz or ham band select, and to change frequencies in specific kilohertz steps like 2.5 kHz, 1 kHz, or 500 Hz. This sub-knob reminds me of the "click-click-click" knob on the Kenwood TS-140. It's a handy feature. The main tuning knob resolves frequency down to 100 Hz (.1 kHz) dial indication, in 25-Hz steps if you ever-so-carefully turn the big knob.

The multifunction knob lets you quickly rotate through 100 memory channel locations that hold a surprising amount of memo-channel information: Receive frequency, mode, any split TX, filter, AGC setting, RF-gain amps or attenuators, noise blanker on or off. This is a very smart memory that might allow you independently to select a CW frequency for fast AGC, narrow filter, no-noise blanker, and RF pre-amp. On an SSB channel, you could memorize slow AGC, noise blanker, -10 dB attenuator, and the normal filter. I considered this versatile memory capability as a definite plus for this very compact rig.

Another nice feature is the high/low power output button. Unlike a slide switch or no power option at all, you can quickly reduce power to local stations or reduce the current consumption of the radio on a dying storage battery.

A dial lock key prevents you from accidentally turning the big knob when tuning channels in from memory. As in Icom transceivers, memory positions allow for instant QSY from the big knob. This allows you to use the small memo knob to get you within a pre-set spot on the dial, and then use the big frequency knob. A quick flick of the small knob instantly puts you back to that original memory position. And when operating from the memory position for the digital modes, you would lock (electronically) the big knob to insure you don't accidentally bump off frequency.

Other buttons and knobs on the front are the RIT capabilities; the "MF SEL" button to select memo, band, or frequency options; the little TX jewel LED that comes on for transmit; delta transmit; memory to permanent VFO selection; memory right, split, and priority—all the usual knobs on a HF transceiver.

If you press and hold the function key twice for longer than 2 seconds, "SE" will appear on the screen indicating you have set the Alinco DX-70 into the set mode. This procedure is similar to that of the Kenwood TS-50 in the "menu" mode. The small multifunction dial selects the many setup options.

The relatively large Alinco DX-70 instruction manual also describes procedures regarding simply resetting the mode settings, resetting all memory channels or VFOs, or performing a major reset of everything as if you had just purchased the equipment new from the dealer.

> ***"It has been many years since I have seen the high-frequency transceiver manufactured with VHF and UHF bands included."***

Connections

On the back of the transceiver are the customary jacks for speaker or headphones, featuring the common miniature jack (not subminiature). There is the common CW jack for connecting a telegraph key or electronic keyer system. It lacks a built-in electronic keyer, but most hams prefer their own style of electronic keyer rather than any type of built-in keyer The CW key-jack is also a miniature jack, not the big 1/4-inch jack you would find on larger equipment.

There are also RCA jacks for ALC as well as relay. When the equipment is new out of the box, the relay is out of circuit. Cutting an obvious internal jumper wire, detailed in the instruction manual, lets the relay close when the microphone or key is depressed. The ALC input voltage from the amp needs to be zero to -3 VDC.

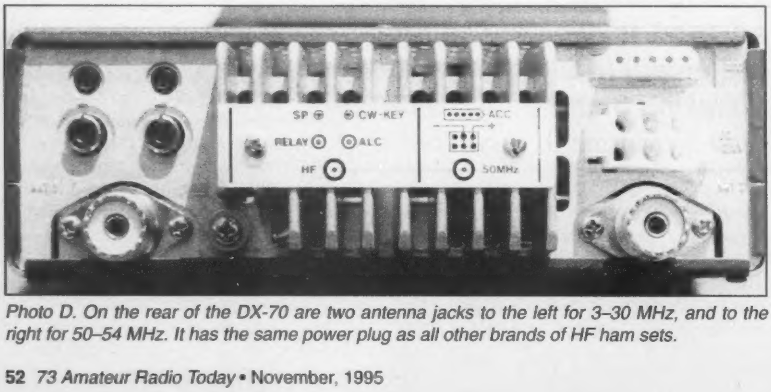

Photo D. On the rear of the DX-70 are two antenna jacks to the left for 3–30 MHz, and to the right for 50–54 MHz. It has the same power plug as all other brands of HF ham sets.

There is a small screw for connecting a ground foil tab, two antenna jacks plainly marked for HF and 6 meters, the heat sink, and then the power connector. More good news: It's the common six-pin power plug that is used by Kenwood, Yaesu, and ICOM from a DC source.

There is an external antenna tuner connection that the manual fully describes as being compatible with a Kenwood AT-50, a Kenwood AT-300, an Icom AH-3, or even an SGC 230 automatic long-wire antenna tuner for field day/maritime mobile/mobile home applications.

While I didn't see an accessory jack for going digital, the microphone offers pin 6 as the detector output with associated pins for PTT, ground, mike ground, and 5 volts DC. Taka at Alinco, an avid HF digital operator, says this radio has full capabilities in the digital modes.

Power Output

Power output on high frequency was a good 100 watts, and I noticed the average modulation level around 60 watts, indicating only slight ALC action. This gave me a good punchy signal that everybody commented about as being "hefty" and sounding great. An SWR protection circuit throttles back output down to 25 watts with no antenna, and a momentary antenna short-out pulled the power down to a safe 5-watt level.

On 10 meters FM, power output was also 100 watts. This surprised me because throughout the bands AM was only 50 watts. On 6 meters, the power output was 15 watts SSB, 11 watts FM, and 6 watts AM.

I then tried operating on 10 meter and 6 meter repeaters, and everything was going along fine in entering the 10 meter 100-kHz offsets as well as the 6 meter 500-kHz offsets. But where, oh, where was the almost-always-necessary CTCSS selections out of menu? Not there! What? No subaudible tone encode? Oh yes, there is, but it uses dip-switch programming.

The CTCSS encode is on the bottom side of the transceiver, with no mention of it in the well-written and illustrated instruction manual. The tone board is already installed, included with the package, but you need your trusty toothpick and penlight to manipulate the eight different switches for any *one* of 38 possible subaudible tones. But besides that, I enjoyed operating the equipment. The only thing I couldn't figure out when running the unit and not reading the instruction manual was how to get it to go into the set mode. As soon as I cracked the books, it was right there.

It has been many years since I have seen the high-frequency transceiver manufactured with VHF and UHF bands included. When you get a chance, head on down to your local amateur radio dealer and take a listen to the sharp high-fidelity action on the new Alinco HF + 6 meter transceiver that has a very bright future. 73

Number 15 on your Feedback card

ASK KABOOM

Your Tech Answer Man

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Get Loud!

You hear it all the time in ham publications: don't buy an HF amplifier, just get a better antenna or raise the one you have up higher. It's basically good advice, but it doesn't always work, does it? Depending on your location, surrounding mountains, sunspot activity, QRM, QRN, and whatever, you can find yourself unable to be heard, no matter what you stick up in the air. Or, you may not be allowed to have a tower . . . or you may not be able to afford one. Whatever the reason, sometimes increasing your output power is your only choice.

So, let's look at HF linear amplifiers. How to buy one, how they work, how you use them, how you don't use them, and how to best make use of the hot, glowing buggers.

Enduring Technology

I usually stay away from this subject, because I consider myself a transistor guy, and the vast majority of amps are tube-based. But, having just bought an amp at a local hamfest, I've had to take a look at the whole topic.

Yes, there are some solid-state HF linear amps, but they're quite expensive and relatively uncommon. For the most part, amplifiers haven't changed much in about 30 years! That isn't from lack of interest on the part of the manufacturers; there just isn't that much you can do to such a simple beast. Probably the biggest innovation has been the no-tune amp, but even that never really caught on in a big way. I don't know why it has remained obscure, but intuition suggests that such a design would be significantly less efficient than one with a nice, high-Q, tunable tank circuit. Another step forward has been the use of microprocessor control. Now there's an odd match, huh? Microprocessors and vacuum tubes. Actually, using a micro to control and store tuning settings is a good idea which makes amplifier use much more convenient and lets you have the best of both worlds: a high-Q tank and freedom from the manual tune-up process. So far, though, such fancy stuff is limited to rather expensive, high-end gear.

Something Old, Something New

So, should you buy a new amp or an old one? At first thought, it makes sense to buy an old one, since the new ones aren't functionally much different, if at all, and they cost quite a bit. Lots of people do buy old amps; I just bought one myself! But, you can get into trouble that way if you're not careful, because tubes are getting expensive and hard to find. And, various amplifiers require different tubes, the price of which can range from $15 to more than $800 each. Ouch! Here are some possibilities you may run into:

Sweep Tubes

Many smaller amps of yesteryear used television sweep tubes. For those too young to remember them, sweep tubes were the ones used to generate the beam-sweeping currents for the yoke coils around the neck of a picture tube. A very common one was the 6LQ6, which also went by the number 6JE6C and a few others. This thing had nine pins on the bottom and an anode cap on top. It was never meant for RF transmitting service, but it could do the job, provided you didn't push it too hard; the plate would glow red and melt down if you tried to dissipate lots of power through the tube. Still, you'll find 6LQ6 tubes in plenty of old amplifiers, like the DenTron GLA-1000 I just bought.

Using any amp requires careful attention to avoiding too much current through the tube, but with sweep tubes you need to be extra careful. You have to tune up quickly, and, when running full-duty-cycle modes like SSTV and RTTY, you have to back off the power quite a bit, lest your tubes become smoldering paperweights. Still, for moderate power output levels of, say, 400-700 watts, sweep tube amps are a decent, cheap alternative to higher-priced units. The upside is that neither the amps nor the tubes cost a great deal. I've seen small amps like mine going for $100-$200 at hamfests. Where else can you get hundreds of watts for that kind of minimal outlay?

The other problem with this kind of amp is that sweep tubes weren't designed for linear service. They will amplify in a linear manner, as will any tube, but even a little overdriving makes them distort a great deal. So, pay extra attention to your radio's output level, and don't push it too hard.

You may also find older amps with 572B and 811A tubes. The 811A was a real transmitting tube, but it's a very old type and not a tremendously powerful one, so you should treat such amps much like sweep tube amps.

The 3-500Z

This Eimac tube is perhaps the most popular one used in more modern amplifiers, and many units in production today use it. These tubes cost about $100–$140 each. That may sound high for a glass bottle, but it really isn't, when you compare its performance to other, more expensive transmitting tubes. The 3-500Z is a good choice. It's a fairly large, powerful tube. You can get full legal output power from one 3-500Z, but that's pushing it, and I wouldn't expect the tube to last a long time under full-load conditions. It's better to get an amp that uses two of them. That way, they'll be loafing along, so they should last for years.

Full Metal-Ceramic Jacket

Metal-ceramic transmitting tubes are used in very high-power commercial installations, and some big ham amplifiers. I once had a DenTron MLA-2500, and it used two 8875 tubes, which were small, metal-ceramic types. Wow, did that thing put out! The tubes were about 20 years old, but it blasted the ether like gangbusters. Although those tubes could dissipate lots of plate current, they were fairly sensitive to grid current, and you could ruin them by overdriving them or transmitting with the amplifier out of tune, because that caused excessive grid current. You sure didn't want to do that, though, because new 8875s cost over $400 each! Used MLA-2500s and similar amps cost about $500–$600 on the hamfest market. If the amp and the tubes are working properly, they're worth it. I wish I still had mine.

Similar metal-ceramic tubes you might run into would be 8877, 8873, 3CX-1000 and 4CX1500A. They all cost a mint, but they're real workhorses that can last the life of the amplifier, and perhaps even the operator, if properly cared for.

Pick One

If you're going to buy a new amp, you can pretty much just pick one from the ads and buy it. There's only a few HF amplifier manufacturers left, so the choice should be easy. Just pick one you like, with the most power you can afford. Chances are, it'll use a 3-500Z or two. Be prepared to spend at least $1000, probably more. If you want to buy a used unit, you have many more choices, because there were lots more amp makers back when ham radio gear was made mostly in this country. Expect to pay from $150 to $600 or so, depending on the age and power of the amp. For a little sweep tube amp, I wouldn't pay over $200, preferably around $125 to $150. For one of the very popular Heathkit SB-220s, around $350 to $500 seems to be the going price. For the big guns, it's $500 and up.

Some designs were prone to parasitic oscillations, which can blow tubes as well as scramble up the spectrum for many miles around, and there were aftermarket kits or factory mods available to fix the problem. When examining a potential purchase, it pays to ask what's been done to it. As with anything, of course, always avoid a unit which appears sloppily modified.

Amateur Beware!

If you buy a used amplifier, be absolutely sure to see it putting out something near its rated power before you plunk your money down. That is, of course, unless the price is so low that you won't mind buying new tubes. I didn't listen to my own advice, and the GLA-1000's seller smiled into my face as he lied and told me that the tubes were brand new and worked great. I got home and discovered the truth: the tubes had no emission at all—they were stone cold dead! Unlike with solid-state devices, tubes can have varying degrees of functionality, including zero. In this case, it wasn't the end of the world; I found a set of good, used tubes at the next 'fest for $15, again taking a chance on the seller's honesty. This time, I got lucky. Had they been 8875s, though, I'd have been in deep doo doo. Be sure to keep the cost of a set of tubes in mind when haggling over a used amplifier!

Wow, this topic is bigger than I expected. Let's continue next time with a look at setting up and using a linear amplifier. Until then, 73 from KB1UM.

Number 16 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

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1691 GOES Converter, The Local Oscillator/Mixer

Well, last month I described the conversion of an LNA or an LNB to cover useful frequencies for 1691 in particular. This type of design does not have to be frequency specific, but the broadband nature of the converted TVRO converter amplifier lends itself to converters from 1,000 MHz to 3.5 GHz. Whatever your frequency of interest, the principal is the same. A good RF amplifier is a mixer and a local oscillator to convert the high frequency to a lower IF frequency for reception.

I have received several letters wondering where to pick up LNA amplifiers. I got mine for this test project at a local hamfest swap meet. Other locations that might show promise is to look in your local telephone directory for satellite television installers. They usually have some of the older LNA amplifiers of the 50 to 100 degree noise temperature units that have been replaced with lower noise figure units, like 20 to 25 degrees. The newer units are much hotter than the older units and are sought after by TVRO users. The units that they replaced are what we want and usually they can be had for about five dollars.

The conversion of these units is not too difficult. Remove the cover and add a two to five pF chip capacitor to the input of the amp where the previous waveguide connection resided. To the other end of this capacitor connect an input RF connector, usually a SMA or whatever your favorite RF connector is. With an Exacto™ knife, remove the frequency-determining stubs, leaving the bias and main connecting 50-ohm stripline connecting all amplifiers. If you have an LNB, add capacitance to the interstage capacitors by doubling up coupling capacitors to lower the frequency response of the IF amplifier. See Figure 1 for more detail covering these modifications.

The mixer I discussed last month was the Mini Circuits SRA-11, which has good RF performance to 2,000 MHz. The units that I tested I modified by soldering SMA connectors to the mixer pins for quick adaptation to many of the different circuits that I tried. See Figure 2 for SRA-11 connections. Other mixers could be used; I used the SRA-11 because it was available in surplus on a scrap PC board. Any other type of mixer could be used, even a home-brewed one similar to the one that I described in this column several years ago.

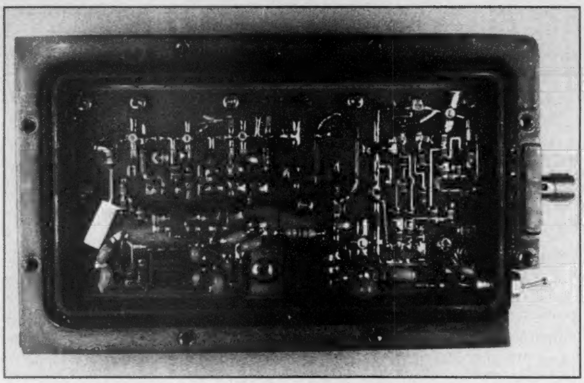


Photo A. Component side view of modified LNB converter. Far left—RF input; right—IF output with feedthrough capacitor for DC power. Mixer just right of center looks like oval racetrack, diode bottom LO input left of racetrack.

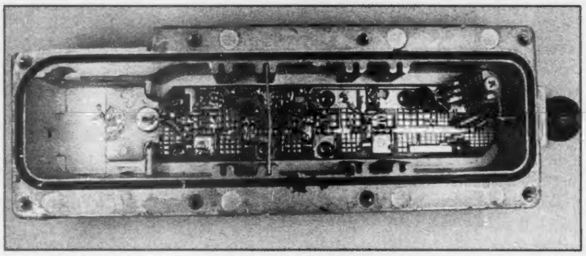


Photo B. Converted 3.7 to 4.2 GHz TVRO LNA converter. Sharp corner above SMA connector is the result of a large waveguide flange removed by bandsawing off the unnecessary metal part of the unit. Left—SMA connector RF input; right—N connector IF output.

The main thrust of this month's column is the local oscillator. It normally would operate on 1554 MHz, using a 137-MHz IF system for weather data reception on 1691 MHz. We obtain 1554 MHz by subtracting the IF from the RF frequency to obtain 1554 MHz.

There are several methods that could be used. One idea would be to use a CATV tuner local oscillator at 1/3 or 1/2 the required frequency. By operating at 1/3 the frequency of 518 MHz, a simple tripler stage and buffer amplifier would be all that is required to be added to the synthesizer-controlled CATV local oscillator. Again, I am using the internal divide-by circuitry in the CATV tuner to input a low-frequency signal to the familiar Motorola MC-145106 synthesizer chip for

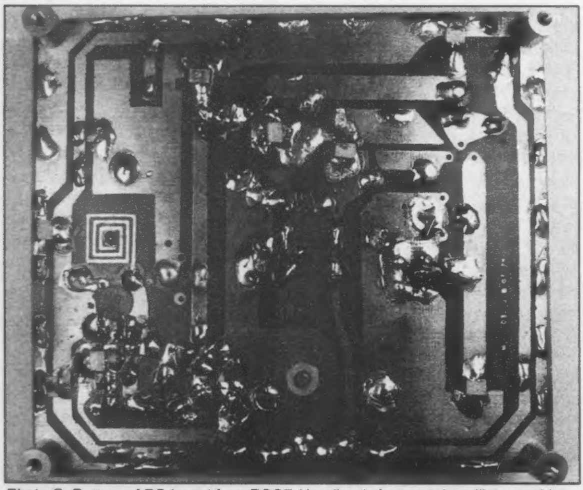


Photo C. Bottom of PC board from RSGB Handbook for crystal oscillator and harmonic multiplier to 500 MHz range. Note PC board inductor for crystal oscillator.

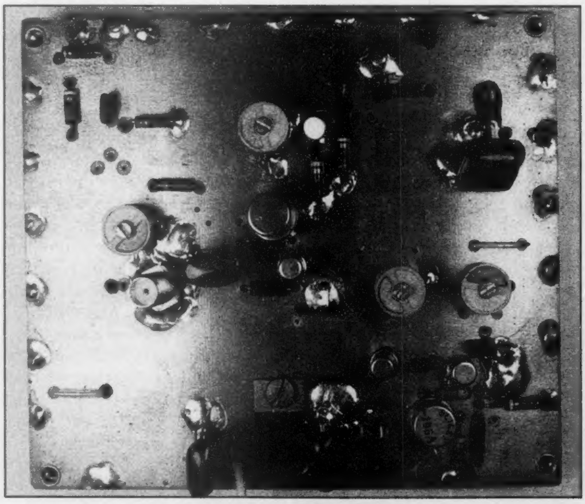
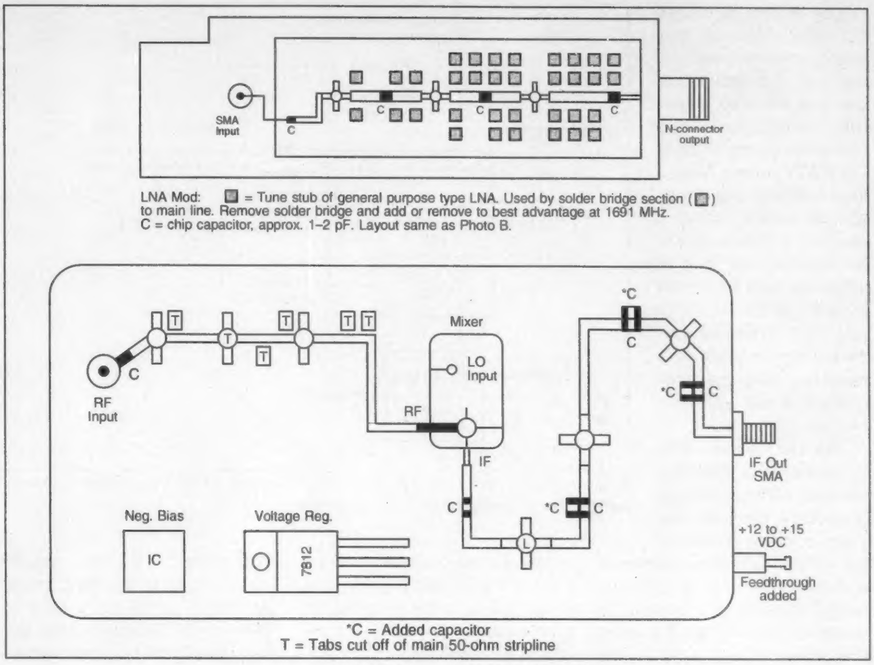


Photo D. Top view of RSGB crystal oscillator.

this type of circuit. See Figure 3 for synthesizer circuitry. Multiplier circuits can be found in many different reference books, such as the *ARRL Handbook's* VHF and UHF sections. Take a look at the designs for the 1296-MHz converter and portions of the circuitry can be adapted from them. Other good sources are the RSGB (Radio Society of Great Britain) VHF, UHF handbook.


SMA Input
C
C
C
C
N-connector output
RF Input
C
T
T
T
T
T
T
Mixer
LO Input
RF
IF
*C
C
*C
C
C
*C
C
L
IF Out SMA
+12 to +15 VDC
Feedthrough added
Neg. Bias
IC
Voltage Reg.
7812

LNA Mod: ▨ = Tune stub of general purpose type LNA. Used by solder bridge section (▨) to main line. Remove solder bridge and add or remove to best advantage at 1691 MHz.
C = chip capacitor, approx. 1–2 pF. Layout same as Photo B.

*C = Added capacitor
T = Tabs cut off of main 50-ohm stripline

Figure 1. Modifications to LNA and LNB amplifiers.

Of course, the local oscillator can take the form of a single crystal starting out at a fraction of the required frequency and going through several multipliers until 1554 MHz is obtained. Sort of like a crystal-controlled transmitter multiplier to the operating frequency for CW operation. This local oscillator operation is quite identical.

The scheme that I would prefer, given a larger budget, is to use a fundamental frequency-controlled local oscillator that is capable of operating on 1554 MHz directly, without multiplication. This type of oscillator is a VCO (Variable Controlled Oscillator). The reason that I did not select a VCO is that most amateurs would have difficulty in obtaining these devices. They are not commonly available. I suspect this project will be attempted by a large number of experimenters and I wanted to name parts easier to obtain. The type and availability of certain dedicated components might hinder those trying to follow a cookbook adaptation of the local oscillator. Remember, I am trying to construct this converter on a shoe-string budget and still make a converter that will perform well.

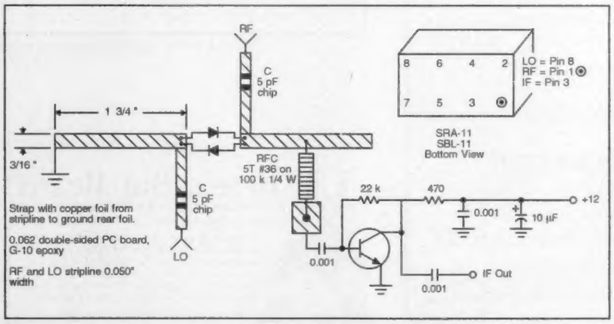
With preferences aside, what is the simplest system that can be constructed and still do a reasonably good job? A synthesizer-controlled oscillator from a TV tuner with its internal divide-by circuitry coupled to the Motorola MC-145106 synthesizer chip for the local oscillator, I believe. A new idea for the mixer allows the local oscillator to operate on one-half the required frequency, eliminating the multiplier stages previously covered. The best part of the new mixer is that it's home constructed.

The home-built mixer is the key to the simplest converter, as the type of mixer I will describe does not require the local oscillator multiplier previously discussed. This mixer design uses one half of the required local oscillator frequency allowing us to use the TV tuner in it's original operation range, making it a simpler system to construct by eliminating complex components and keeping costs low.

The Technical Bits and Pieces

Our complete system would comprise a converted TVRO converter amplifier (LNA) for a home-built mixer, a synthesizer controlling a TV tuner local oscillator, and an optional IF amplifier to complete the part of the packaged converter. See Figure 4 for the package block diagram.

Looking at the TV tuner, it in itself is a complete IF converter for a set block of frequencies. CATV type tuners are made to cover


RF
C
5 pF
chip
1 3/4"
3/16"
RFC
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100 k 1/4 W
C
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chip
LO
22 k
470
0.001
10 µF
+12
0.001
0.001
IF Out
8
6
4
2
7
5
3
LO = Pin 8
RF = Pin 1
IF = Pin 3
SRA-11
SBL-11
Bottom View
Strap with copper foil from stripline to ground rear foil.
0.062 double-sided PC board, G-10 epoxy
RF and LO stripline 0.050" width

Figure 2. Mixer considerations for SRA-11 and home-built mixer circuits. Note that the home-constructed mixer requires half local oscillator frequency injection (777 MHz) as opposed to 1554 MHz.

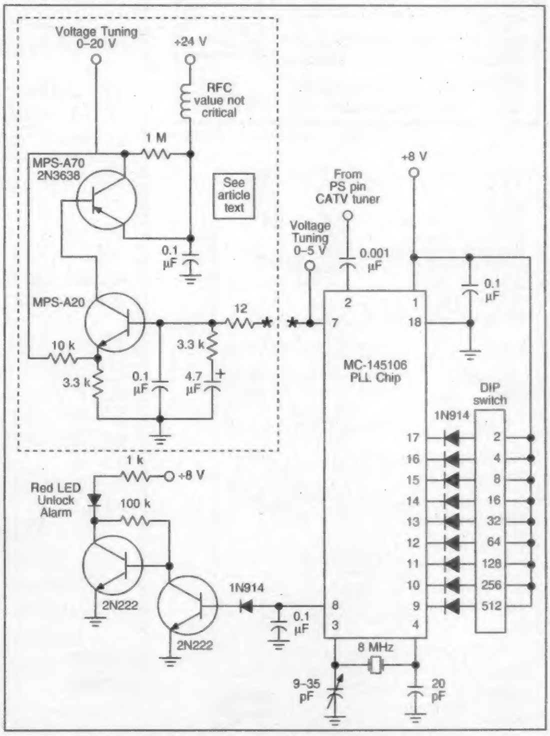
Voltage Tuning 0–20 V
+24 V
RFC value not critical
1 M
MPS-A70
2N3638
See article text
0.1 µF
MPS-A20
10 k
3.3 k
0.1 µF
4.7 µF
3.3 k
12
From PS pin CATV tuner
Voltage Tuning 0–5 V
0.001 µF
+8 V
0.1 µF
2
1
7
18
MC-145106 PLL Chip
DIP switch
1N914
17
16
15
14
13
12
11
10
9
2
4
8
16
32
64
128
256
512
1 k
+8 V
Red LED Unlock Alarm
100 k
2N222
2N222
1N914
0.1 µF
8
3
4
8 MHz
9–35 pF
20 pF

Figure 3. MC-145106 synthesizer schematic details.

ranges of from 50 to over 500 MHz. As such, they lend themselves readily to this type of project. In addition to the amp, mixer, and bandpass filters (which we do not require), the CATV tuners have a local oscillator that is variable by voltage control. It also has a internal divide-by frequency chip that divides the high frequency by a fixed 256 division rate. This divider reduces the LO high frequency to a frequency within the range of the Motorola synthesizer chip.

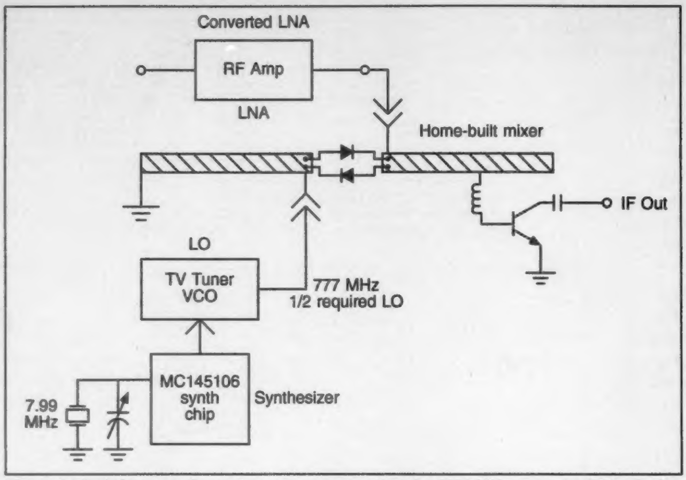

Figure 4. Block Diagram of complete system connections for 1691 MHz converter. Filters for isolation and out of frequency immunity not shown.

The synthesizer chip contains two different counter strings or programmable dividers. One string is for the division of the crystal-controlled reference and the other is to set the required division rate needed to match the output of the LO when it is phased locked to the crystal reference frequency. Both these outputs are connected internally to a phase comparitor which produces an output voltage to control the variable oscillator and set it (with the proper division rate programmed in the synthesizer) to the same frequency as the crystal reference frequency.

In our case, the crystal is 8 MHz exactly and is being divided by 1024, the reference frequency being 7.8125 kHz. Now when the VCO in the CATV tuner is operating on 778 MHz, the fixed divide-by internal to the CATV tuner is 256 making 3.0390625 MHz being output to the Motorola synthesizer chip's divide-by circuitry. By setting the MC-145106 oscillator divide-by rate (can be set from 2 to 511 maximum) to 389, the output of this divide-by chain is exactly 7.8125 kHz, and the synthesizer is locked up and happy.

Of course, when power is applied, nothing is further from the truth. However, when the crystal oscillator starts operating and the 7.8xxx kHz main crystal reference is input to the phase comparitor, the main CATV oscillator is set to some frequency and is being divided down by, first, 256 in the converter, and 389 in the synthesizer chip. At first, the frequency is quite in error and the phase comparitor outputs a correction voltage to bring the variable oscillator in check. It continues to doso either raising or lowering the voltage to make the two frequencies the same. Hopefully, within the voltage pull-in range of the phase comparitor.

I have included in previous articles on the 1296 MHz converter how to lower the tuning voltage sensitivity to allow direct connection to the MC-145106. Also in-

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cluded is an interface if you want to increase the voltage tuning range from zero to five volts, to zero to 20 volts by adding the two-transistor circuit. Its a flavor choice item on your part.

Oh, I forgot to tell you—we want to operate on 1554 MHz and while I was working with perfect numbers like 8 MHz and such, I left out this detail. Adjust the crystal lower in frequency by about one kilohertz to permit half LO, or 777 MHz, to be realized. Actual reference frequency required is 7.802458226 kHz which is obtained by dividing 777 MHz by 256 (CATV Tuner) and dividing the quotient by 389 (programmed in the MC 145106 chip). If you set the 8-MHz crystal to 7.98717224 MHz this will all work out. Actually the 8-MHz crystal used as system clock is set 1.3 kHz low in frequency by padding a junk 8-MHz crystal. If you want to be a purist, order a crystal for the exact frequency.

The frequency stability of the system will be just as stable as the 8-MHz crystal is. If you choose to use a higher stability source, it will work as well. It can be connected to pin 3 and ground of the MC-145106 synthesizer chip.

Mixer Construction

As I said, the mixer requires half LO frequency, making this mixer a little unusual but practical, as it affords a simple construction without adjustment. The mixer first surfaced in simple converters for the 2304 MHz amateur band and some TV receiving applications quite a few years ago. It was part of the coffee-can-type of converters popular back then. I have noticed reference to them in *Ham Radio Magazine* in August 1978 and in the 4th edition of *The RSGB VHF/UHF Handbook*. The real source is a mystery to me.

> ***"Oh, I forgot to tell you— we want to operate on 1554 MHz and while I was working with perfect numbers like 8 MHz and such, I left out this detail."***

The mixer is constructed on .062 inch double-sided PC board material with the rear of the board serving as a grounded-foil ground plane surface. The top surface is where the pattern of the mixer is etched or cut out with an Exacto™ knife—dimensions are not critical. The main stripline is 3/16-inch wide and 3 1/2-inch long, broken in the middle for connection to the two diodes. The local oscillator connection is made to the grounded section of the transmission line at the diode connection point. The other stripline is open at its end and the connection is made to the diodes at that point. The IF feed is taken off with a small 5 turn RFC (5 turns #36 enameled wire on a 1/4-watt, 100k resistor form) midpoint along the side of the strip line. The large pad that the other end of the RFC attaches to form a capacitance to ground, shorting out at 1691 MHz, and is a higher impedance at 137 MHz. See Figure 5 for mixer construction details.

Don't forget to have one end of the mixer stripline grounded at one end with as short as possible a piece of copper strap to ground. It forms a shorted transmission line to ground for the local oscillator injection port. The other side of the diodes are connected to the IF output ports of the mixer.

A single-stage IF amplifier finishes out the mixer circuitry. This stage was originally constructed with a type MRF-901 as was the original circuit where I got some of the ideas for this simple converter. Other NPN-type high frequency transistors could be used in this application; it's not fussy. I tried an Avantek AT-85067 NPN-type and it worked as well.

Well that's it for this month. As always, I will be glad to answer amateur-related questions concerning this and other projects. Please send a SASE for prompt response. 73 Chuck WB6IGP. ■

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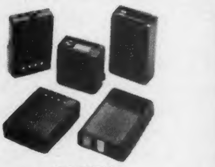

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FNB-26	7.2v @	1200 MAH
**FNB-26(S)	7.2v @	1500 MAH
FNB-27	12v @	600 MAH
**FNB-27(S)	12v @	800 MAH
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FNB-31	4.8v @	600 MAH
FNB-33(S)	4.8v @	1500 MAH
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HAMSATS

Amateur Radio Via Satellites

Andy MacAllister, WA5ZIB
14714 Knights Way Drive
Houston, TX 77083

Digital data and communications via satellite have come a long way since the first OSCAR (Orbiting Satellite Carrying Amateur Radio) was launched in 1961. OSCAR-1 sent "HI" in Morse Code. The speed of the CW was calibrated to the satellite's temperature. It was digital, and it was real telemetry, but times have changed.

Today we have many amateur-radio satellites for both analog and digital communications. To keep up with the analog satellites, an enthusiast uses many modes that are commonly found on the shortwave bands. Voice operation with SSB or FM and standard CW are the most common. Typical VHF and UHF, multimode transceivers are employed without any modifications.

By comparison, digital satellite communications have become quite complex. AMSAT-OSCAR-7 used RTTY over 20 years ago for telemetry transmission. Today AMSAT-OSCAR-13 uses a mix of CW, RTTY, and 400-baud PSK (phase-shift keying) for its telemetry downlink, while other satellites like KITSAT-OSCAR-25 are orbiting digital bulletin board systems operating at 9,600 baud utilizing a form of AX.25 packet. Other satellites like Weber-OSCAR-18 send data and pictures at 1,200-baud PSK, and DOVE-OSCAR-17 sends standard 1,200 baud FM packet data. These are just a few of the digital modes our digital hamsats can employ.

Keeping up with the advances in digital communications via satellite can become expensive. Whenever a new mode is incorporated into a satellite design, the ground-based user needs a new black box to keep up. But there is an alternative. Instead of designing new hardware for each mode, a processing system can be designed to handle many different modes, just by changing software. Today's DSP (digital signal processing) circuits have allowed many prospective digital satellite users an easier path to high-speed operation at 9,600 baud in addition to computerized decoding of RTTY, CW, and even APT weather satellite imagery.

> ***"The complexity of a kit that could be built, calibrated, and used by hams with reasonably advanced kit-building experience was a key issue."***

The TAPR DSP-93

Photo A. The DSP-93 modem kit from TAPR includes all parts, circuit boards, cables, connectors, case, and instructions.

The Tucson Amateur Packet Radio Corporation (TAPR) and the Radio Amateur Satellite Corporation (AMSAT) began a joint project in 1988 to create a DSP device for amateur radio use. The complexity of a kit that could be built, calibrated, and used by hams with reasonably advanced kit-building experience was a key issue. After careful study, a system proposed by Bob Stricklin N5BRG was chosen. It was modular, relatively inexpensive ($430), and could be easily interfaced to various input and output devices, such as radios and packet TNCs (terminal node controllers).

Principal design criteria had been identified in April 1993 at the Dayton HamVention. The DSP-93 unit became a standalone unit to support data, audio, and slow-scan video modes when coupled with appropriate software.

The project proceeded from alpha- and beta-test units in 1993 and early 1994, to a first production run in late 1994. A second production run came out in mid-1995. The kit is centered around two four-layer circuit boards with an interconnecting bus structure.

The boards are mounted one above the other with the DSP engine on the lower of the two. This board has a TMS320C25 DSP chip, 32k by 16 bits of program and data memory, the clock circuitry and system I/O using PALs (programmable array logic). The upper board contains the radio and computer interface circuitry.

Radio connections are through two mini-DIN connectors (cable included). Computer access is via a standard DB-9 serial connection at speeds up to 19.2 kbaud, and the TNC connection is via a DB-25 connector. There are two other connections to the

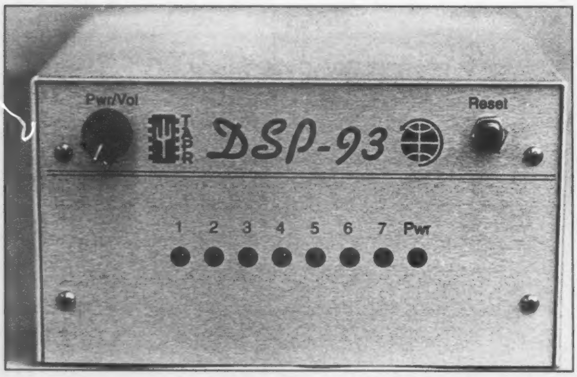

Photo B. The front panel of one of the first DSP-93 modems. Newer units have a black front panel with white lettering.

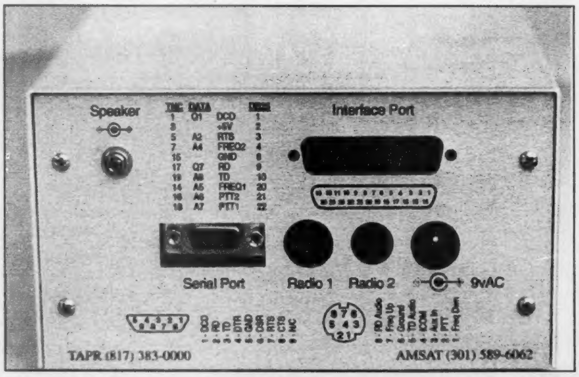

Photo C. The back panel of the DSP-93 is neat and well labeled. The interface port connector on this unit was replaced with a ribbon cable from the modem to the TNC.

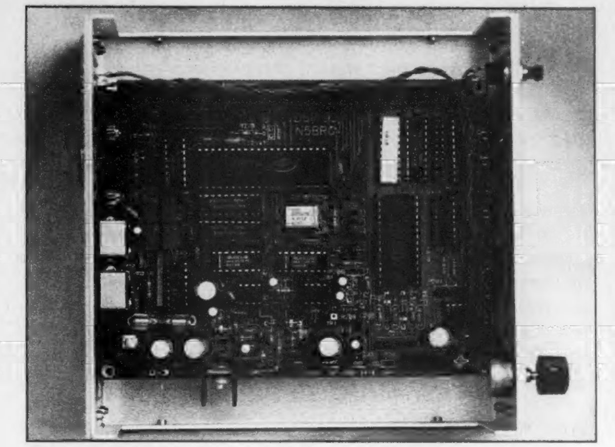

Photo D. Looking inside the DSP-93 at the top circuit board for the radio interface circuitry.

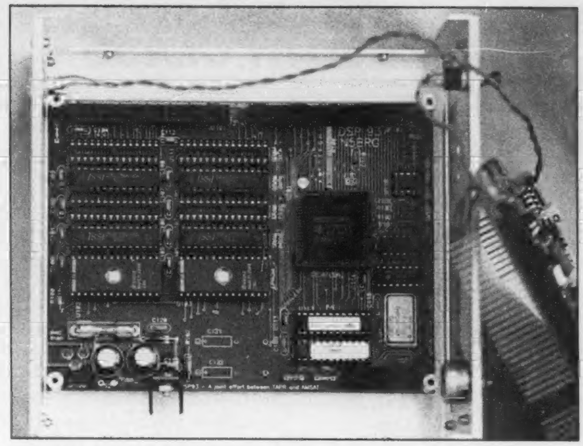

Photo E. Lifting the top board out of the case reveals the DSP Engine with the TMS320C25 DSP IC, memory system, and programmable array logic.

unit for speaker output and power input. The kit comes with a wall transformer that provides nine volts AC at 1.5 amps. External controls include power on/off, volume, a reset switch and an array of eight LEDs that are software configurable to display system status and other functions.

Building the Kit

The DSP-93 is not a simple kit. There are a few hundred parts, and working with four-layer circuit boards can be very messy if the wrong components are installed in a spot and must be removed and replaced. Building time for most has been between 10 and 20 hours with another 4 to 8 to make cables and interface to radios and other gear. Very little wiring external to the circuit boards is required. Most of the connectors for the unit are mounted directly to the upper radio/computer I/O board.

The assembly manual is 33 pages long, is very easy to follow, and spells out the procedures needed to successfully complete the unit. Well-placed notes and warnings are common throughout the text. There's even a little dry humor at appropriate points in the construction. Some information about the connections to the TNC and radios assumes some prior knowledge, but is at least covered via the schematics and documentation files on the supplied disks.

On the Air

Most of those buying and building the DSP-93 get it for 9,600-baud FSK packet work, either terrestrial or via satellite. The simplest way to get going for this mode includes connections to one or two radios using a single radio port jack on the DSP-93. Information is provided on how to connect to various radios for the high-speed modem connection.

The connection to the TNC requires a modem disconnect header interface (typical on TAPR TNCs and clones) back to the DSP-93 using five wires. Four-conductor shielded cable works. A few lines are cut inside the TNC to allow the use of the external modem.

"How many modem boxes does it take to work all the digital modes in the sky? One."

Unlike hardware external modems, the DSP-93 must be told how to operate via software upload. The kit includes two disks with modem programs and text files explaining system use for various functions. To get on the air with 9,600-baud satellites, a program called DSPLOAD is used in conjunction with the program FSKP1.OBJ to set the system for full-duplex, 9,600-baud communications through radio port number one. This is done via the serial port on the DSP-93. The unit is then ready to operate like any other 9,600-baud hardware modem hooked to a TNC.

Software is currently available through TAPR for 9,600-baud work via satellite or terrestrial, and also for TPRS. Some other modes include 1,200-baud AFSK or PSK, 400-baud PSK, RTTY, AMTOR, 300-baud FSK, APT pictures via weather satellite, noise filtering, CW filtering, oscilloscope and spectrum analyzer emulation, and various diagnostic functions. For those with Internet connections, use FTP (file transfer protocol) and attach to ftp.tapr.org to get software and document files. You can also call or write to TAPR. The phone number is (817) 383-0000 from 9 am till noon and from 3 pm to 5 pm Central Time. The address is 8987-309 E. Tanque Verde Rd. #337, Tucson, AZ 85749-9399.

The DSP-93 Future

New software is in development all the time. The DSP-93 is an open architecture, and it is hoped that as more amateurs get their units, more software will be developed and distributed. Some ideas under study include SSTV, speech synthesis, and new data modulation formats.

The modular design of the unit allows either of the main boards to be replaced with future boards designed for unique applications. A faster radio/computer interface could be installed, or as new DSP chips become available, the DSP engine board could be swapped out. There is room in the current box for a TNC interface board, thus making the modem a complete unit with internal TNC.

The DSP-93 system is not the only DSP unit on the market, but it is less expensive, and, for the experienced kit builder, a lot of fun to put together and a very useful tool when complete. How many modem boxes does it take to work all the digital modes in the sky? One. 73

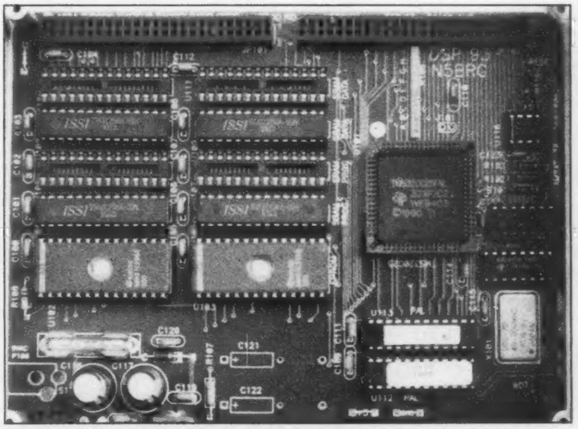

Photo F. A close-up of the DSP engine circuit board, the heart of the DSP-93.

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New Resources

The transition from the relaxing days of summer vacation to the structured setting of the classroom is a rough one for teachers as well as students. Be that as it may, it's time to get back into gear with renewed energy—mentally and physically. The start of a new school year is a good time to look over your resource center and classroom library. Discard materials that are outdated or irrelevant, for it's the appropriate time to add new resources to your collection.

As we've discussed in this column before, it's extremely important for instructors and teachers to be interested, stimulated, and involved in order to have the class of adults or children think that they are interesting and stimulating teachers. Keeping yourself up to date with new equipment and the plethora of electronic data that has become available can sometimes become overwhelming. Do what you can. But do something! If you can add a dozen new resources to your repertoire, you're doing fine.

The following are materials and resources that have recently come to my attention and are worth passing along to you as suggestions. As you experiment with new reference materials in your ham radio classes, be sure to drop me a line if you think they are worthy of sharing with others.

1. You can simplify your search for specific children's books with the 1995 edition of *Children's Books of the Year.* Published by the Child Study Children's Book Committee, this annotated list includes more than 600 titles selected from more than 4,000 new books for children, from infants to age 14. Titles are arranged according to age and interest. A special new feature is an insert that lists 20 books, old and new, challenging gender stereotyping. The list may be ordered by sending a check for $6 to Children's Book Committee, Bank Street College, 610 W. 112th St., Dept. LM, New York, NY 10025.

> ***"Keeping yourself up to date with new equipment and the plethora of electronic data that has become available can sometimes become overwhelming."***

2. A book that can be adapted for children or adults is *What's Inside? Spacecraft* by Dorling Kindersley, Inc. I use this book with my radio classes to introduce the unit on "Space Travel and Communications." It describes how a rocket gets into space, what it's like to travel in a lunar module, and how astronauts manage to spend months on a space station. The Russian space station, *Mir,* is even described with diagrams.

3. NASA Teacher Resource Centers in 11 locations around the country offer educational videotapes, slides, audiotapes, publications, teaching guides, and more. Call the NASA Goddard Space Flight Center Teacher Resource Laboratory at (301)286-8570 to ask for the location and phone number of the center nearest you.

4. Tony Lacy G4AUD has written a computer program that performs Morse Code drills and prepares sample VE type exams. It's called "NuMorse." It is written to run under the Microsoft Windows operating environment (most other Morse Code programs operate only in DOS). It is distributed as shareware via the CompuServe online service. The program runs under Windows 3.1. It provides a source of accurately generated code that can be as slow as required in the early stages, and then gradually increased. For more information write to: A. Lacy, 58 Bilbrook Road, Codsall, Wolverhampton WV8 1ER, United Kingdom, or call Donald Bell KI5YT at (817) 761-9207, fax (817) 761-9277.

5. Joseph Carr K4IPV, a fellow columnist in *73 Amateur Radio Today,* is always coming up with creative materials to use in the classroom. His "Crash Course in Statistics," a multimedia course on CD-ROM, is too advanced for my kids in 6th–8th grade, but gifted math students and those in the upper grades will probably enjoy and learn from the program. Each subject is broken into easily understood units. You learn at your own pace, repeating sections and topics as often as you wish. Voice narration, animated graphics, interactive examples, sound effects, and video clips make the subject come alive in a way not possible with books. System requirements are: 386 PC (or higher), Windows 3.1, 4 MB RAM (8 MB suggested), 256 color monitor, 8-bit sound card, CD-ROM Drive, and a Mouse. A 144-page study guide and desk reference supplement the CD-ROM. Carol Lewis of HighText Publications wrote the CD-ROM software, and Joe wrote the book. Joe Carr can be reached at (703) 941-1230.

I wish all of you teachers and instructors the very best of successes with your classes this year. Don't be shy; share your suggestions and success and/or failure stories with the rest of us. Exchanging experiences and techniques will add to your own stimulation, which will then translate into better, more exciting lessons and presentations. Good luck!

Photo A. You should continue to update all resource materials in the classroom.

Photo B. Globes, maps, and atlases are some of the resources needed in ham radio classrooms.

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Thanks!

November is the month of Thanksgiving, and, every year at this time, I am reminded about the many things to be thankful for in this world of ours. While it may not be one of the biggest things, the readership of this column continues to deserve my personal thanks. To wit, let's take a look at what some of you have recently sent my way.

James Thomas drops a note from Taiwan, where he is the Sysop of the World Data Exchange Information Service, having read about the XPCOM program. He says that he just got his hands on an IC-7100, IC-R72, and CT-17 interface controller from ICOM, and can't find a program in Taiwan or on the Internet that will allow the ICOM CT-17 to control his two ICOM radios via the computer. He is looking for any leads on where on the Internet such a program could be found.

Well, James, I searched the literature, I have, as well as the Internet, using various search engines, and came up blank also. Readers who think they could help, can E-mail James at root@twwde.com.tw being sure to send me a copy of the information, as well. Let's see what the RTTY Loopers out there can do!

A note from Michael Cotty N9RIK strikes a familiar chord. He asks for information as to how to shield a PC in order to cut down on interference to a two meter radio. He is trying to run the BayCom software, and appears to be having some problems.

Michael, if you have an older computer, one with a plastic case, you may be in real trouble. Shielding those babies can give new meaning to the term "exercise in frustration." On the other hand, most newer computers are built inside of shielded cases to comply with FCC regulations for home electronics (Class B devices). Therefore, most spurious emissions are not coming from the computer, but from cables which enter and exit the computer. Solution? Shield, shield, shield. Use some old shield braid from coax around interconnecting cables. If that does not entirely remove the interference, try a ferrite bead or toroid. Suspect cables. There may already be one on your keyboard and monitor lead: take a look. Good Luck, and keep us posted on your progress.

Bob KF8PH tells of his purchase of a sound card with the AMD DSP chip at Dayton this past spring. He also acquired a Radware "radio on a PC card" which he uses for receive from time to time. He is looking for an OS/2 driver for the card, but has found the search fruitless to date. Anyone out there that can help, we would be interested in hearing about it.

While we're off the MS-DOS track, I received a message from Rejean Bisson, VE2BSE, who says:

"I could use your help in getting JNOS or KA9Q for SCO UNIX ODT 3.2.4. I operate this at my house, and I love it, but I have just a version of KA9Q, which does not support TCP/IP on my local network. I have TCP/IP and NFS on my system, and I would like to be able to do Telnet and FTP locally.

"Presently, I use JNOS 1.10i in DOS, and with this version all is okay, but I would like to try running the UNIX version on my machine, and closing down the DOS server."

While I have no ready source, I am delighted to open it up to the readership. Contact @internet: Rejean at rejean_bisson@inno.org or ve2bse@n0ary if you can help.

Back to the BayCom systems, Kelly Copley dropped me an inquiry looking for companies which produce the BayCom interface. One *73* advertiser who has been featuring such a device is Tigertronics, Inc. For about $50, their BayPac modem is a tad bigger than a DB-25 connector, and features everything needed to run BayCom on your computer, with no external power required! Contact them at 1-800-8BAYPAC, or (503) 474-6700 for those who cannot access US toll-free lines. See their ad in this month's *73 Magazine*.

Can it all be high-tech? Nah, here's a note from John P. Cummin, Sr., AD4S who says:

"I have a complete model 28 that used to belong to the local weatherman, Johnny Beckman W4BTX. But no documentation. Sure would like to get my hands on a model 28 manual. I do have a complete model 19 manual from years ago. My brother, W5CE, and I are working toward some kind of a ham radio, computer museum, and want to get as much of the old stuff working as possible. I have an ST-6 demodulator that I plan to use. Any help would be greatly appreciated . . . glad to pay postage, etc. p.s. I have been subscribing to *73* since January 1961 and, until I had a water pipe break in my basement, had every issue. Certainly have enjoyed your column through all those years. Thanks for all the effort."

Contact him at SGRG82A@prodigy.com if you can help out. I'm sure that someone out there has a manual mildewing in the basement.

As to your p.s., for less than $300, the complete series of *73*, as well as other ham radio magazines, is available on microfiche from Buckmaster. I have no idea if they plan to issue the collection on CD-ROM instead of fiche, but that sure would be nice. You might contact them, look on the World Wide Web at http://www.buck.com/ as mentioned last month.

As I write this column, the east coast of the United States has had a month of drought, and the hurricanes in the Atlantic passed the halfway point in the alphabet. This month's Web site features all you need to look at what's going on with weather, and weather related information. Check out http://user.itl.net/~equinox/index2.html for Solar Information and World Weather Index, invaluable to the radio amateur.

In the beginning of this column, I suggested that there are some things which may be, shudder, more meaningful than ham radio. Let me suggest something to you, if you haven't thought of it already. Every day, thousands of people's lives are in jeopardy, waiting for an organ donation. I'm not talking about high-profile actors or athletes, but ordinary mothers, fathers, and children; all races and religions; unified in their need. Be an organ donor. Think of organ donation if you are faced with a tragic loss in your family. Believe me, you never know when it can happen in your own home. ■

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Atlanta Balloonatics

On August 5th, a group called the Atlanta Balloonatics launched a high-altitude weather balloon from Crossroads Elementary School in Dallas, Georgia. Attached to the balloon were two separate payloads containing ham radio experiments.

The ATV-Beacon Package

David Rice KD4SHH built the ATV and 2m beacon section of the first payload. The ATV section consisted of a P.C. Electronics KPA5-RC transmitter on 434 MHz feeding a quarter-wave coaxial whip antenna and a miniature b/w camera pointed out the side of the payload. The 2m transmitter was an Agrelo Engineering half-watt FM unit sending out a modulated CW telemetry sequence.

Will Payne N4YWK built the telemetry and 10 meter beacon section out of a Basic Stamp module and a 12-bit A/D converter (for the pressure sensor altimeter). The CW telemetry sent back values representing both inside and outside temperature as well as altitude. The telemetry was carried on the 2m FM transmitter on 146.575 MHz, the 10m CW transmitter (a keyed clock oscillator module on 28.322 MHz) as well as the ATV audio subcarrier. Two fiberglass fishing rods (complete with flags attached to the ends) were mounted horizontally to the styrofoam package to support the 10 meter dipole and to help keep the payload from spinning wildly during the flight.

In addition to the telemetry the Basic Stamp controlled a small R/C servo that periodically lowered a small mirror in front of the TV camera to provide a view of the ground below. The power source consisted of a lithium-cell pack.

The APRS/GPS Package

Ralph Fowler N4NEQ put together a separate payload containing an APRS/GPS automatic positioning system. This compact system consisted of a Motorola Basic Oncore GPS board, a PacComm Pico Packet and a TEKK radio on 441.0 MHz running 2 watts of output power. This system was designed to take the guesswork out of DFing a balloon in flight since this payload would constantly update its latitude, longitude, and altitude. Since the Pico Packet formats the GPS string into an APRS compatible format, anyone on the ground running APRS could follow the balloon position as it tracked across the APRS map. It was planned to relay the balloon's position to the APRS network on 145.79 and 10.151 MHz, so that those outside the local coverage area could follow the flight as well.

The Chase

Although delayed by poor weather at the launchsite earlier in the morning, a break in the clouds allowed a launch just after 11 am. Unfortunately, as the balloon was released, the swivel attachment to the last payload broke leaving the APRS/GPS payload on the ground as the ATV system headed skyward. It was one of the fastest recoveries of a balloon payload (and one of the shortest flights!). Had the packet payload made it off the ground, it would've set yet another record. It turns out that while inflating the balloon, the payload had been sitting on an anthill. As we inspected the grounded payload, we discovered that dozens of "Antronauts" had almost hitched a ride to the edge of space!

The ATV signal was somewhat weak during the flight, but even so was received as far away as Huntsville, Alabama, by Gene Marcus W3PM. The 2m signal was heard in Huntsville by KE4EER as well as throughout the southeast and even attracted the attention of a group near Anderson, South Carolina. They were concerned that someone in Atlanta must've been running incredible power (way over the legal limit) to be heard so far away without a band opening. They were amazed when they discovered that the bone-crushing signal was actually only around 1/2 watt (antenna height really makes a difference!) and they're looking forward to listening to more balloon flights.

Around eight tracking vehicles set out to follow the balloon's progress as it headed up to 100,000 feet in altitude. Without

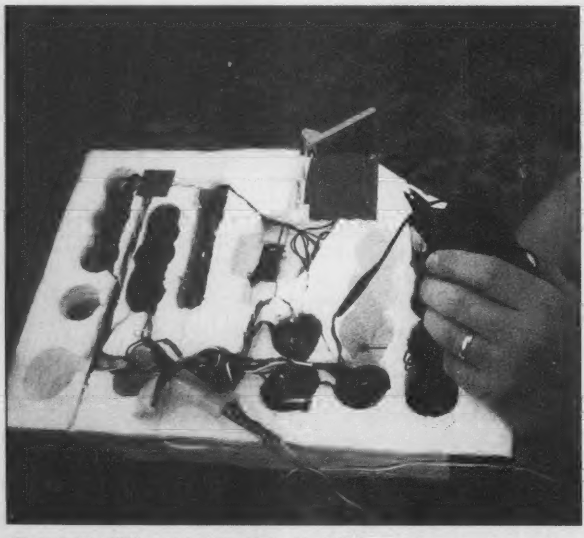

Photo A. The ATV and telemetry payload included a live camera and a servo-controlled mirror to view both the ground and the horizon.

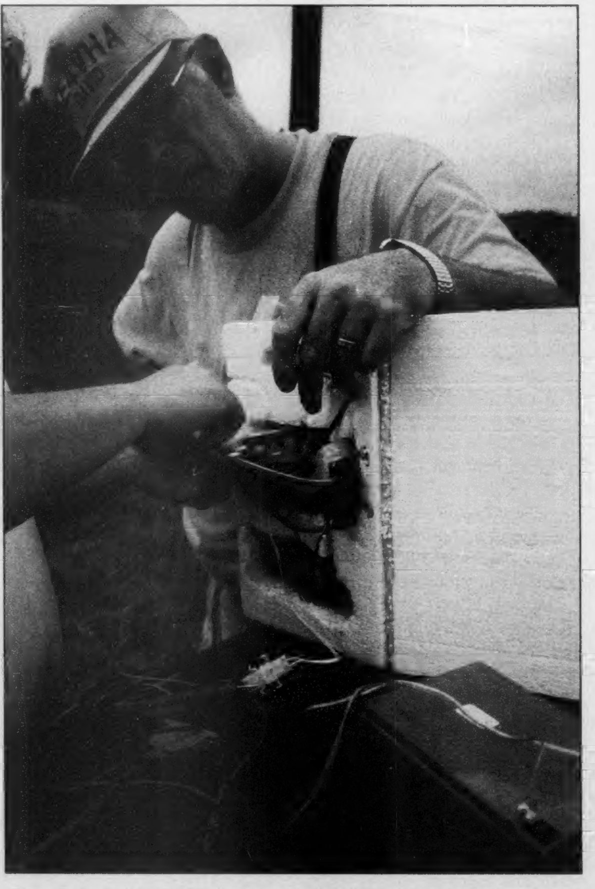

Photo B. As David KE4VHA looks on, Ralph N4NEQ makes final adjustments to the GPS/APRS payload prior to its attempted liftoff.

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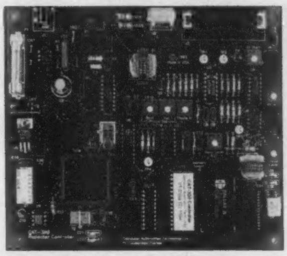

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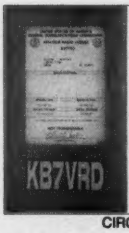

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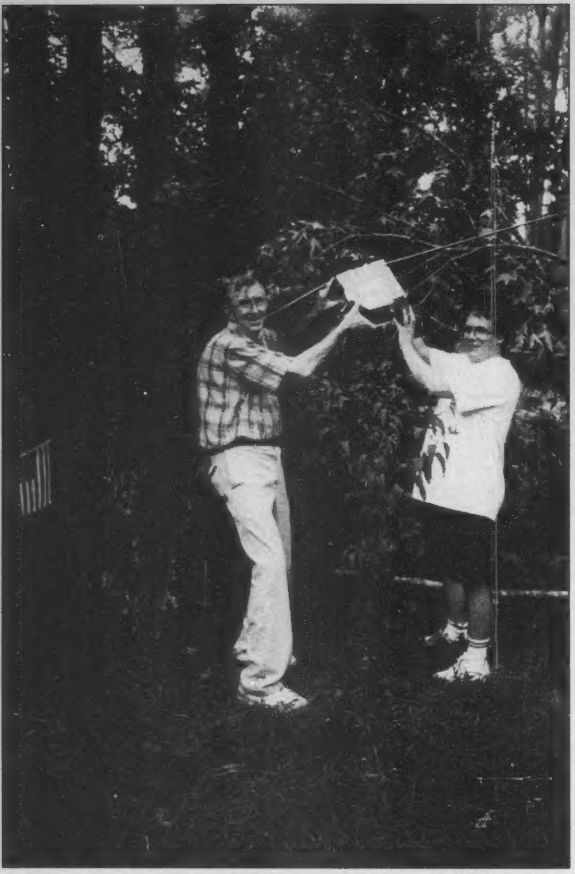

Photo C. Left to right: Robert Kicker N5QBF and Ralph Fowler N4NEQ retrieve the ATV payload from the uppermost branches of the fallen tree.

Photo D. The Atlanta Balloonatics are thrilled to have finally recovered their payload after an exciting chase and retrieval.

the GPS payload, we had to track it the old-fashioned way with directional antennas and Doppler systems. Many of the chase team had APRS/GPS systems in their vehicle, which made the job of triangulating bearings for mission control a breeze. In the mobile command center (KE4VHA's motor home), Phil N4NBL and Tom KE4WIO used the APRS program to automatically track the positions and plot the bearings of the APRS-equipped chase vehicles. Bearings from vehicles without packet could be manually entered at mission control and plotted as well.

Many of the tracking vehicles were using a unique and very sensitive Doppler tracking system (called Directional Systems) developed by Jim Sorenson KA4IIA. For more information about this system send Jim email to: KA4IIA@radio.org.

I headed out with my friend Melody Johnson and stopped on a hill near the predicted landing point. Unfortunately, the only DF equipment we had with us was a 2-element quad to receive the ATV picture. As the payload descended on parachute after the balloon burst, we were able to track the location fairly well just by twisting the quad back and forth while sticking it out of the sunroof of Melody's car. At one point, it appeared to pass directly over the car. By taking note of the updated location from the tracking net and a seat-of-the-pants guess, we zipped off to the northeast. After the payload landed, no one could hear any signals. After a few minutes we topped a small rise, and were thrilled to hear the 2m beacon weakly break the squelch. Mostly by following Melody's intuition, we got close enough to finally see the ATV picture. As we drove into the driveway of the Evers farm, we had a snow-free picture showing lots of tree tops as the payload swung around in the wind. Within a few minutes, Mr. Evers' formerly peaceful farm was inundated with foxhunters carrying strange antennas as the chase teams converged on the payload's signals. The Evers carried us across their cow pasture with 4-wheel motorcycles and a golf cart where we discovered the payload hanging about 100 feet up in a Sweet Gum tree; way too high to climb safely.

> ***"After a few minutes we topped a small rise, and were thrilled to hear the 2m beacon weakly break the squelch."***

Mr. Evers' son tried to shoot the payload down with a dozen rounds from his rifle, but only managed to shoot a few limbs off near the payload. Finally, Will N4YWK climbed 20 feet up with a cable and tied it to the tree. His descent from the tree was less than graceful, but he did manage not to break anything!

After all else failed, the rifle was put away and the chainsaw was brought out. As Mike Ray WA4YUR's truck winch pulled, the tree smashed down with a great snapping crash narrowly missing the front of the truck. The chase crew ran up to the former top of the tree and gently plucked the payload out of the limbs. Amazingly, after all of the abuse, the payload was still transmitting a perfect picture and the mirror mechanism still worked flawlessly!

We ended up sawing up the tree and stacking the wood neatly for the Evers family. Everyone left happy, we had the payload and the Evers had a lot of new firewood. We even ended up with 19 pounds of freshly picked okra that was handed to us as we departed. You meet the nicest folks when you drop balloon payloads on their property!

The Atlanta ATV WWW Page

For those of you who enjoy surfing the World Wide Web on the Internet, you can find out about upcoming flights sponsored by the Atlanta Balloonatics as well as pages of information about APRS (maps of the Atlanta area are available for downloading), the Big Shanty Repeater Group, and the Atlanta Amateur Television Network. Start out at the home page address of http://www.mindspring.com/~rwf to begin your visit.

There are charts to decode the balloon's CW telemetry information, construction projects complete with schematics and diagrams for ATV and links to other ATV groups' home pages. Currently, you can link directly to the ATN (Amateur Television Network—Southern California), the East Tennessee ATV group, and the Houston Amateur Television Society.

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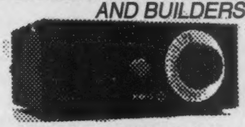

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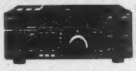

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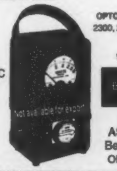

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Op-Amp Bandpass, Peaking, and Notch Filters

Traditional filter circuits are made of inductor (L) and capacitor (C) elements arrayed in passive, frequency selective circuits. All such circuits have an insertion loss (gain of -dB) associated with them, and under the right circumstances they don't filter properly. Indeed, there are load and input impedance combinations that make a filter actually peak, rather than attenuate, certain frequencies in the stop band. Active filters, on the other hand, are made using an active element (such as an operational amplifier), so have gain rather than loss. They are also a bit more predictable as to performance because they do not depend so heavily on having the proper input and output impedances. In this article, we will take a look at examples of active bandpass, peaking, and notch filters.

Filter Characteristics

Three different forms of active filter are discussed in this article, so it's appropriate to take a look at the frequency response characteristics of all three. The response for a bandpass filter with a moderate bandwidth is shown in Figure 1A. The bandwidth of the filter varies across its entire passband, so for the purposes of standardization the bandwidth is measured at the point where the response drops off -3 dB from the peak response at the center frequency (F_c), or in the terms of Figure 1A the frequency difference F_H-F_L.

A "figure of merit" for the filter is termed "Q," which is the ratio of center frequency to -3 dB bandwidth. For example, if the center frequency is 1,000 Hz, and the bandwidth is 250 Hz, then the Q is 1,000/250, or 4. The general rule is that the higher the Q, the narrower the bandwidth.

A wider bandwidth—that is, lower Q—bandpass filter frequency response is shown in Figure 1B. In this case, the -3 dB points are wider apart than in Figure 1A. A filter such as this might be used in a transmitter modulator to limit the audio bandwidth, or in a receiver audio preamplifier to limit the bandwidth to that of the transmitted audio.

A special case of bandpass filter is shown in Figure 1C. This circuit is called a peaking response because it is very narrow, and will accentuate frequencies in the immediate vicinity of F_c, and attenuate all others. An example of an application for this type of circuit is in low-cost CW receivers. The peaking circuit center frequency (F_c) can be positioned over the desired tone, causing it to be accentuated in the receiver output and to attenuate interfering signals away from the center frequency.

Table 1

F_c (Hz)	C1(μF)	C2(μF)	R1	R2	R3
100	0.1	0.1	47.7k	536	477k
250	0.1	0.1	19k	215	191k
500	0.1	0.1	9.5k	107	95.5k
1,000	0.01	0.01	47.7k	536	477k
5,000	0.001	0.001	95.4k	1,072	954k
10,000	0.001	0.001	47.5k	534	475k

The inverse of the peaking response is the band reject, or notch filter, response shown in Figure 1D. This response is used when one wants to eliminate a given frequency. It is often used in the same CW receivers as the peaking circuit, but is used to notch out nearby interfering signals. A low-cost home-brew receiver can benefit quite a bit from an audio section that combines the peaking and notching filters.

Another application for the notch filter is to eliminate 60-Hz interference from scientific and medical instruments. Radiation from power lines will get into the input circuits of sensitive instruments, causing problems. For example, your doctor's electrocardiograph (ECG) machine uses electrodes attached to wires from a multi-wire cable to measure voltage drops caused by the beating of your heart. These leads are typically unshielded at the very ends, and thus are susceptible to picking up 60-Hz signals from the power lines. As a result, many ECG machines either use a filter all the time or have a filter that can be switched in to eliminate the interference (the switched version is usually preferred in diagnostic machines because all filters distort the processed waveform at least a small amount).

Multiple Feedback Path Bandpass Filter

The multiple feedback path (MFP) bandpass filter is shown in Figure 2. The equations for the component values are also shown in Figure 2, and are valid for $10 \leq Q \leq 20$ and gains ≤ 15. The values of the components given are for a 2.2-kHz center frequency, a gain of 5 and a Q of 15 (about 150 Hz). Other combina-

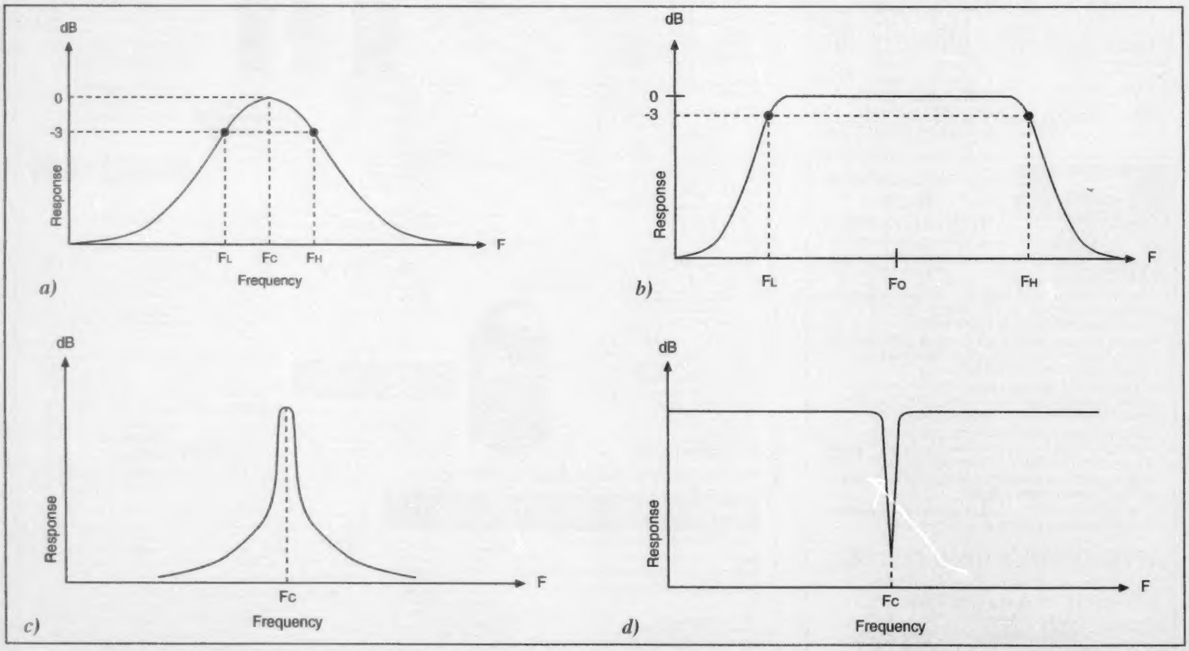

Figure 1. Frequency responses for: A) Moderate Q bandpass filter; B) Low-Q bandpass filter; C) peaking filter; D) notch filter.

tions can be calculated from the equations, or taken from Table 1.

Alternatively, there you can use a filter calculator program such as FilterMaker to find the values for other center frequency, gain and Q combinations (see end of column).

Peaking Filter Circuit

The circuit for a narrowband peaking filter is shown in Figure 3. This circuit is basically a noninverting amplifier with positive feedback. The negative feedback path is set to unity by a direct connection between the output terminal of the operational amplifier and the inverting (-) input. A frequency selective RC network connects the output to the noninverting (+) input, providing some positive feedback. The center frequency is:

$$F_c = 1/2\pi R1\ (C1C2)^{1/2} \qquad (1)$$

Where F_c is the center frequency in hertz (Hz), R1 is in ohms, C1 and C2 are in farads.

Notch Filter

A notch filter rejects a narrow band of frequencies around the design center frequency. Figure 4 shows a type of notch filter based on the peaking circuit of Figure 3 (A2), along with another operational amplifier (A1). The circuit of amplifier A1 has an unusual configuration: The input signal is applied to both the inverting (-) and noninverting (+) inputs. The feedback resistor (R3) is connected in the usual manner from the output of the operational amplifier to the inverting input. The peaking circuit, which in this case sets the notch, is connected between the noninverting input and ground. The notch frequency is set by the same equation (equation 1 above) as for the peaking circuit.

I've used this circuit at both 60 Hz and at about 800 Hz (for a low-cost CW receiver), and found it worked fine. The capacitor (C1) can be used to tune the notch frequency. In some cases, you may want to use a trimmer capacitor for C1, in which case the frequency will be tuned once and then left. This is the case for a 60-Hz filter. In other cases, C1 will be a shaft-operated variable capacitor that can be tuned from the front

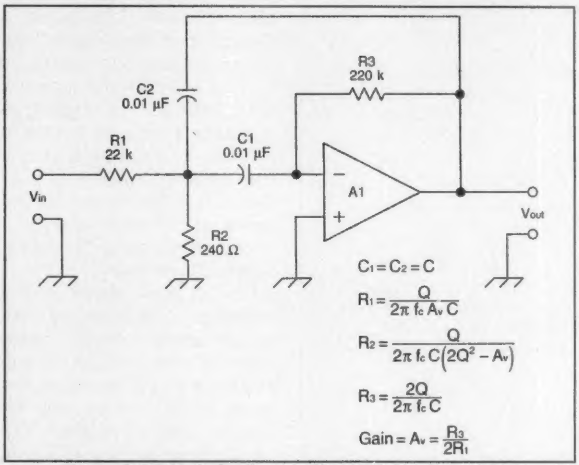
R3
220 k
C2
0.01 µF
R1
22 k
C1
0.01 µF
Vin
A1
Vout
R2
240 Ω
C1 = C2 = C
R1 = Q / 2π fc Av C
R2 = Q / 2π fc C(2Q² − Av)
R3 = 2Q / 2π fc C
Gain = Av = R3 / 2R1

Figure 2. Multiple feedback path (MFP) bandpass filter.

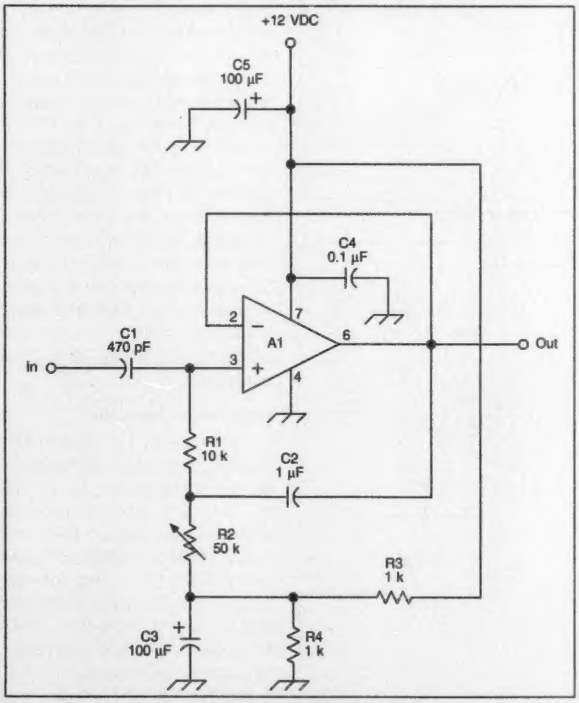
+12 VDC
C5
100 µF
C4
0.1 µF
2
7
A1
6
Out
C1
470 pF
In
3
4
R1
10 k
C2
1 µF
R2
50 k
R3
1 k
C3
100 µF
R4
1 k

Figure 3. Peaking filter circuit.

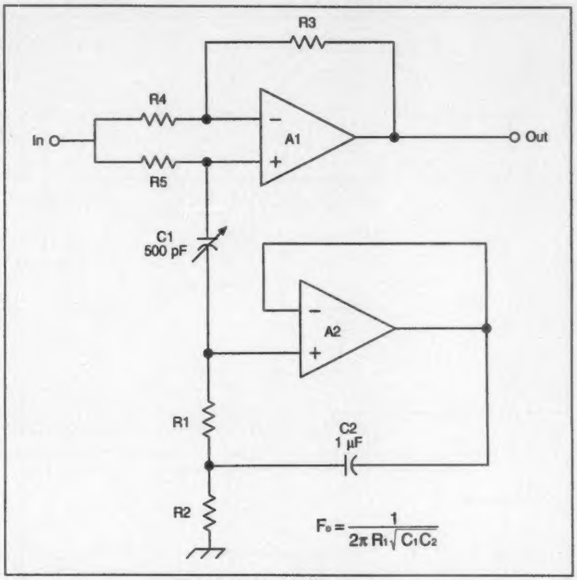
R3
R4
In
A1
Out
R5
C1
500 pF
A2
R1
C2
1 µF
R2
Fo = 1 / 2π R1 √(C1C2)

Figure 4. Notch filter circuit.

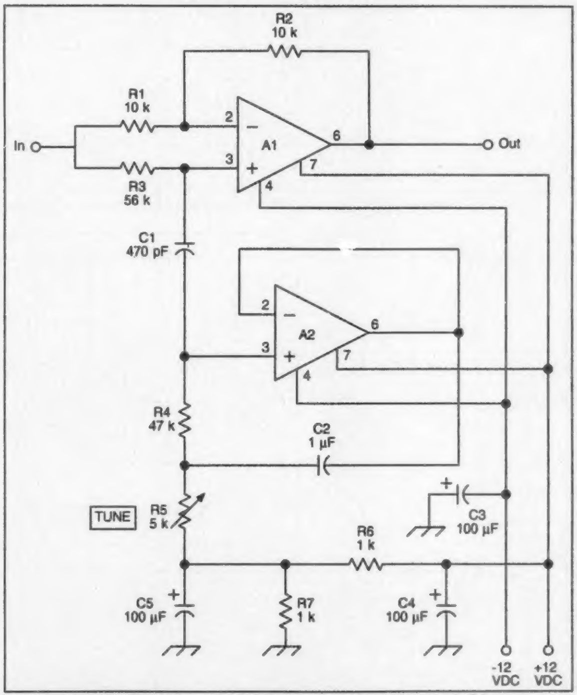
R2
10 k
R1
10 k
In
2
3
A1
6
7
4
Out
R3
56 k
C1
470 pF
2
3
A2
6
7
4
R4
47 k
C2
1 µF
TUNE
R5
5 k
C3
100 µF
R6
1 k
C5
100 µF
R7
1 k
C4
100 µF
-12
VDC
+12
VDC

Figure 5. 600 to 3,000 Hz resistor tunable notch filter.

Table 2

Frequency Range (kHz)	Inductance Range	C1 Value
34–68 kHz	2.7–10.9 mH	250 pF
68–137 kHz	0.68–2.7 mH	62 pF

panel of the project (as in a receiver).

Figure 5 shows a version of the notch filter that will tune roughly from 600 Hz to 3 kHz, and has been used by ham and SWL builders for a number of years. It is used for notching out unwanted CW stations, or for notching out heterodynes in receiver outputs. Insert this filter between the headphone output of the receiver and a power amplifier stage.

Gyrator Bandpass Filters

The gyrator circuit (Figure 6) has been around for a number of years. This active circuit can be used in place of an inductor. With two operational amplifiers (two sections of a dual or quad op-amp are preferred), the value of the inductance simulated by this circuit is:

$$L = R1\ R3\ R5/(R2/C4) \tag{2}$$

or, in the case where R2 = R3,

$$L = R1\ R5\ C4 \tag{3}$$

In a previous article, I discussed the very low frequency (VLF) receiver used by members of the American Association of Variable Star Observers—Solar Division (AAVSO-SD) to monitor frequencies in the 17- to 30-kHz region (designed by Art Stokes N8BN). Since then, I was contacted by the head of the organization and informed that a gyrator version was now the preferred circuit. The main problem with all previous VLF receivers was that the inductors have very large values (≈50–120 mH), and are thus hard to find in variable forms. The gyrator receiver (also a Stokes design) solves that problem.

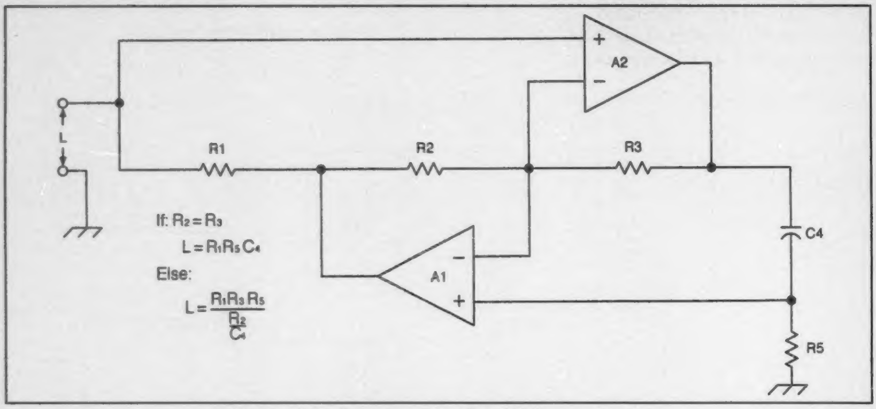

Figure 6. Basic gyrator simulated inductor circuit.

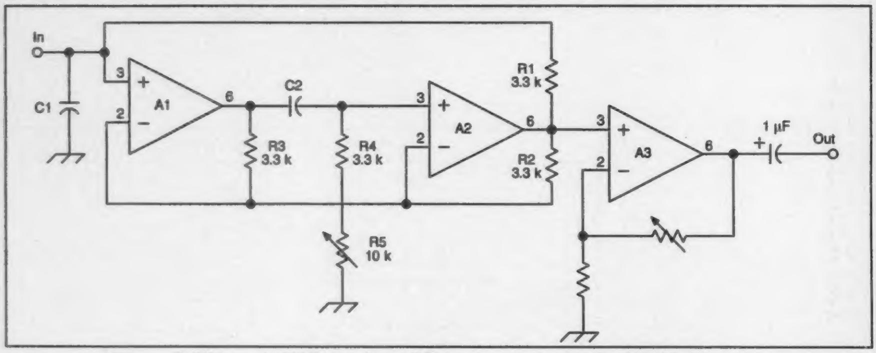

Figure 7. Ultrasonic/VLF tuned amplifier using a gyrator-simulated inductance.

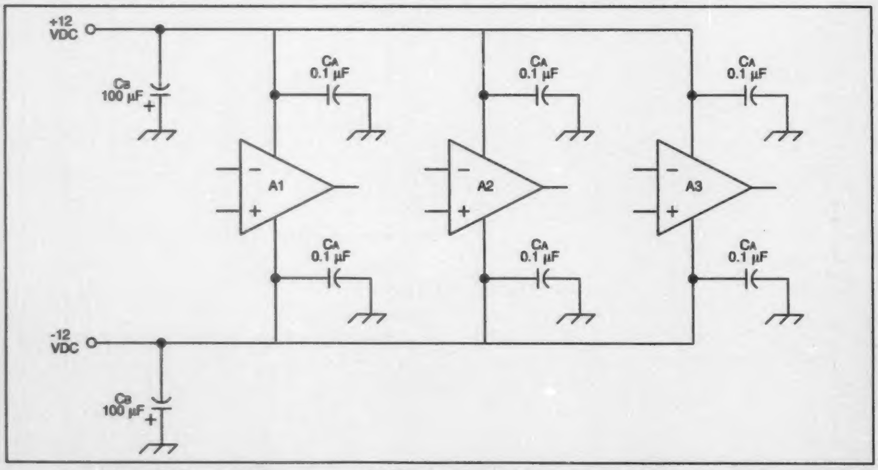

Figure 8. Proper DC power supply filtering for multistage or multi-op-amp circuits.

The RF portion of the VLF receiver is shown in Figure 7 (a precise rectifier/filter circuit is needed following the output of Figure 7 to generate the DC signal monitored by SID-hunters). To tune the SID-hunting frequencies, C2 is 0.001 µF. The range of inductance simulated is 10.9 to 43.9 mH. If C1 is a 0.002 µF unit, then the tuning range is 17 to 34 kHz. Other ranges can be obtained with the same value of C1 (0.002 µF) by using the component values of Table 2.

The DC power distribution of multistage, or multi-op-amp, filter circuits needs to be well conditioned in order to prevent oscillation either in one op-amp or, because of poor power supply, decoupling between op-amps. Figure 8 shows the proper way to keep these problems under control. The capacitors marked C_A are 0.1 µF to 1 µF, and must be mounted as close to the body of the protected operational amplifier as possible. A larger capacitor (marked CB in Figure 8), 100 µF to 500 µF, is connected between each power supply line and ground, usually at the point of connection to the power supply. Note that these capacitors are polarity sensitive, and so must be connected into the circuit properly or they may be damaged (large value electrolytic capacitors can blow up if connected into a circuit backwards!).

FilterMaker Software

The values for bandpass, peaking, and notch active filters shown in this article, as well as the values for passive low-pass and high-pass filters, can be calculated from a Windows program called FilterMaker. This software is available from the author for $20.00 at P.O. Box 1099, Falls Church, VA 22041. System requirements include a 1.44-megabyte floppy drive, and Windows 3.1 or higher. ■

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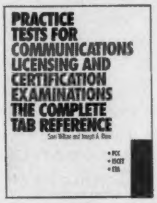
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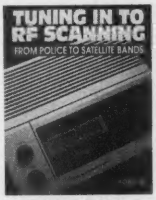
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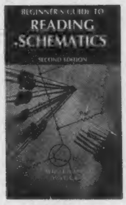
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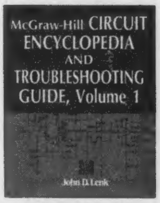
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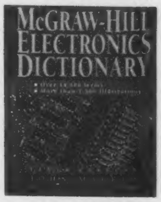
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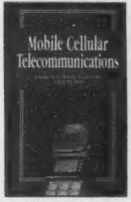
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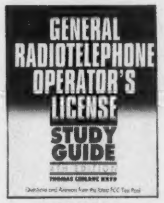
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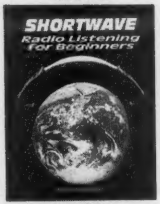
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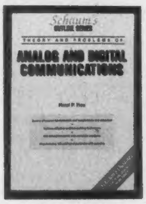
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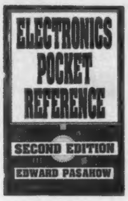
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QRP

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Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

Add 'Em On

With all this talk about RIT circuits, and other add ons for the Small Wonder Labs rigs, I guess it is about time that I mention how you can get your own copy.

Currently, the Small Wonder Lab transceivers are made for 160, 80, 40 and 30 meters. Sorry, a 20 meter version is NOT available. To get your own Small Wonder, just send a check or money order to:

Small Wonder Labs
Dave Benson
80 E. Robbins Ave
Newington, CT 06111

The Small Wonder Lab rigs are $50. The matching case is $32. The RIT is $7. The prices include shipping on all items.

The Small Wonder Labs transceiver does not have an RIT. But, you can either home-brew something up or get one that will work right off of the get go. In fact, order one from Dave when you place your order.

The schematic shown is the RIT from Dave. It's really simple to build. Dave gave me permission to reprint the schematic and PC board for his RIT.

Here's how this RIT works. Remember, the Small Wonder Lab transceiver's frequency is controlled by a varactor diode.

The heart of the RIT is the CD4066 quad analog switch. This 14-pin DIP package contains four small SPST switches. Each switch is insulated from its brothers and all four are "turned on" by applying a voltage to one of the control pins. A "high" applied on any given control pin will cause the switch to be on.

How it works is, if the RIT is on, pin 13 is normally high, closing the switch at pins 1 and 2, thus connecting the RIT pot to the transceiver's varicap biasing network. When the transmitter is keyed, or the RIT is turn off manually, by switch S1, the RIT is removed from the varicap network. Switch section consisting of pins 10, 11, and 12 forms a network along with the 5.1k resistor to ensure the transmitter is not affected during key down. As long as pin 12 and 13 are high, the RIT is functional. Keying the transmitter pulls pin 13 to ground via diode D1. The 100k resistor pulls up both pins to the V_{CC}.

As an afterthought, and I have not tried this yet, you could snitch a slight amount of voltage from pin 12 to drive a transistor switch. This switch would then drive an LED to show if the RIT is active or not. Use typical junk box parts such as a 2N2222 or a 2N4401 transistor. Tap off of the unregulated side of the V_{CC}: the onboard regulator is only rated at 100 mA.

Since this is such a simple project, and there is a PC board available, that is what I would use to assemble the RIT circuit. But, there is nothing wrong with some perfboard and hard-wiring the critter, either.

I added a 0.1-µF capacitor onto pin 14 of the CD4066 chip. This capacitor will keep most of the crud from the IC. I guess a 22-µF capacitor tacked onto pin 14 would not be a bad idea, either.

There is room on the board for a few mounting holes. These are not drilled. I chose not to drill the holes for two reasons. First, I really did not want to mess up the case I had my 30-30 in. Second, I could not find the drill. So in keeping with classic home-brewing in mind, I used a patch of double sided foam tape. Works great! The RIT went under the main PC board with the leads running out from the right-hand side. This kept the lead lengths as short as possible on their way to the tuning pot.

The RIT works surprisingly well considering the simple nature of the circuit. If you have one of the original Dave Benson radios, the RIT may decrease the available tuning range. To compensate for this, you must remove C9 and replace it with a value of 50 percent larger. Some fine tuning tinkering will no doubt be required.

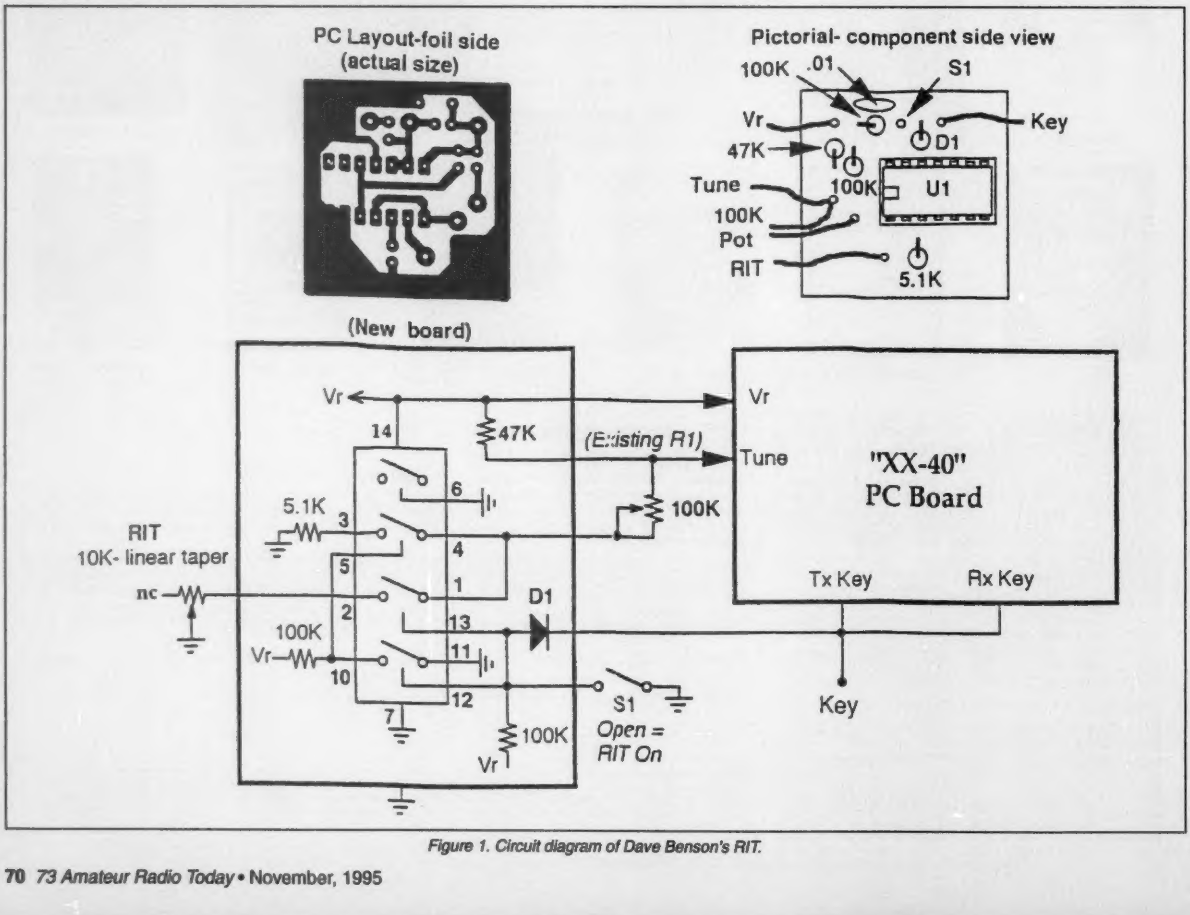

Figure 1. Circuit diagram of Dave Benson's RIT.

Building a circuit requiring a negative supply? Really want to use an audio filter but the op-amps need a separate minus supply? Well, start laying out the circuit board because Linear Technology has a new CMOS voltage converter in a simple 8-pin dip IC. It's the LTC660.

This guy will source up to 100 mA while boosting a power conversion efficiency of 88% with a 100-mA load. It's simple to use. There's only two external capacitors needed. Most of the Linear Technology chips are in stock from Digi-Key electronics. Ask for one of their catalogs.

Good Books

Since the days are growing shorter, now is the time to get that old HW-8 up and running. I have a pile of the HW-8 Handbooks left. They contain modifications for the HW-8, HW-9, and a few mods for the HW-7. They're only $11 and that includes first class postage.

If the bands are dead this coming winter, then how about curling up with a good book? You can get a complete set of the *QRPP* published by the NorCal QRP club. This is great reading even if you're like Scott N8JSK who has no idea what end of the soldering iron gets hot.

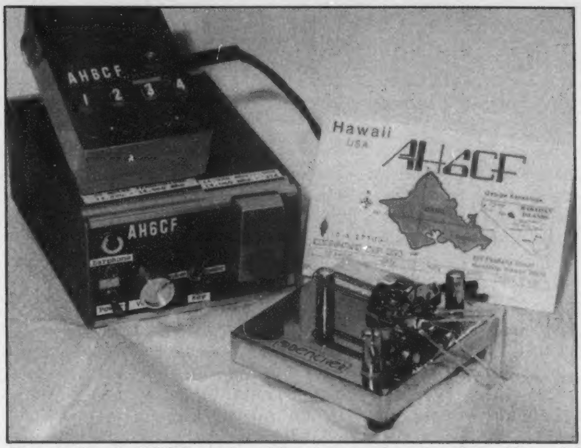

Photo A. Here is AH6CF's version of Dave's transceiver. Note the multi-turn dial for tuning.

Drop a card (with postage, please) to Doug Hendricks, KI6DS, 862 Frank Ave, Dos Palos, CA 93620. Doug has put together all the issues of *QRPP* into one huge book. This book will surely generate some all-night building binges! The price is $15.

Figuring Your Solar Needs

Most QRPers like to operate their stations on solar power. How many panels and how many batteries will it take? Instead of number crunching by hand, let your Macintosh do the work for you. I have coded a HyperCard stack that will calculate the number of solar panels, the amount of batteries required, and tell you the minimum array-to-load ratio. Why, I even figured out how to generate charts for the various reports. SunCad Lite has an extensive database of all current and out-of-production solar modules. There's also a rather busy database of lead-acid batteries to choose from. There is solar isolation data for all states (some are not active yet) as well. But, best of all, it's free! SunCad Lite requires HyperCard 2.2 and at least four Megs of RAM. If you don't have HyperCard 2.2, then ask for the stand-alone application that does not require HyperCard. Just send a Macintosh-formatted blank disk with return postage to my address. State if you want the stack or the stand-alone version. I'll send it right out to you. SunCad Lite is great fun for playing "what ifs" by changing modules or modifying your loads.

Next month, we'll look at some simple circuits to improve your low power equipment. In the mean time, everyone have a great Thanksgiving! ■

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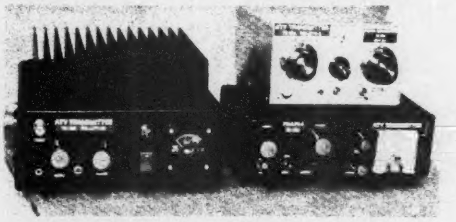

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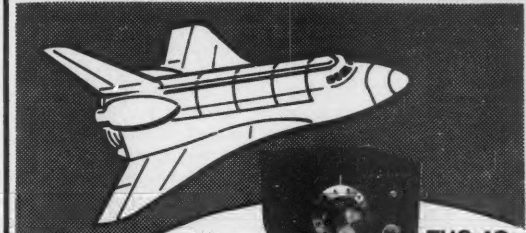

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HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
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What Do *You* Want?

In last month's issue we inaugurated a new column, "Ham To Ham." In HTH we're looking for interesting ham-radio-related tips, techniques, equipment modifications, workshop shortcuts, just about anything that would be interesting information to pass on to others, young and old alike. We very much need your input to keep the column vibrant, so jot down your ideas or discoveries and send them to me at the adress above. *73 Magazine* will somehow eke out $10 for each idea that's published in this column, plus you'll be helping countless other hams worldwide who can benefit from your experiences. Every legitimate idea will be promptly acknowledged, and the author will be notified if the tip will in fact be used in an upcoming column. We're looking for original ideas and suggestions, ones that haven't been published before, which have been successfully used and can be duplicated by our readers in their own station setups.

We also invite any comments on the column as well as suggestions on its direction and content. What format would be most valuable to you, the reader? Do you want strictly technical tips or a combination of both technical and operating ideas? Is the conversational style most helpful, or should each tip be simply edited and listed individually? This is your column, so be sure to let me know how you would like to see it conducted. Your comments will be extremely helpful in making the guidelines for this new medium of information exchange within *73's* pages—let's keep it "Ham to Ham."

Too Much Trust?

We all tend to trust new parts a bit too much, I know I'm guilty of the same naiveté at times. When I set out to build or repair some item of ham gear, I inevitably assume that the new parts that I'm using are good. The vast majority of the time, that works just fine. Besides, what else can you do?

A friend of mine works for a manufacturer of electronic control panels, and they use lots of off-the-shelf electronic parts. He has come across diodes with the cathode band imprinted on the wrong end (the anode end), resistors whose color codes are mismarked and capacitors that are either misidentified, are open, or even shorted. Just about every electronic part problem possible is experienced by any large manufacturing firm dealing in electronic circuit construction.

These abnormalities happen fairly often when dealing with thousands of parts in the "real world" of electronic manufacturing. The point of all of this is that it pays to check the parts you'll be using in your next electronic project. It's so much easier to check a part before soldering it in place and it's so much wiser to eliminate any problems before applying power to the circuit, possibly damaging perfectly good parts.

The Case of The Non-Insulating Adhesives

Here's a really sneaky little gremlin that can creep into your electronic circuit boards completely unnoticed! On several troubleshooting expeditions I've encountered the adhesive used in some equipment to hold parts down on the foil side of the PC board becoming semi-conductive!

It's something that you wouldn't normally expect to happen, but it appears that some of these adhesive compounds tend to dry out over time. The condition can often be accelerated by the wide temperature variations that are encountered in mobile installations, but it can also occur in home-based equipment as well. As the adhesive dries out, it can become hydroscopic, picking up moisture from the air, which can then result in the adhesive compound itself becoming partially conductive. When bridged across the conductive pads on the foil side of a printed circuit board, this semi-conductive substance can wreak havoc on high-impedance circuits with which it comes in contact. PLL feedback loops, high-impedance oscillators and high-voltage circuits are just a couple of examples of circuitry that can be profoundly affected by semi-conductive adhesive compounds.

I've also seen a few of these adhesives apparently change molecularly, eating through the colored protective board coating and then becoming semi-conductive so that they result in high- to medium-impedance short circuits. This can occur even if the adhesive is seemingly on top of the board's insulating coating. If the adhesive mixture is slightly acidic and left unaddressed, it can eventually even etch through the copper traces themselves.

When such insulating property changes are even suspected in a piece of malfunctioning equipment, remove all of the old adhesive compound from the foil side of the board as completely as possible, and then clean up the surrounding area of the board as best you can before proceding with any other troubleshooting, being careful not to damage the board any further than it may have already been. If you choose to apply another type of adhesive on the foil side of the board, be sure to pick one that you know will not wind up presenting you with the same or similar problem down the road.

Check for Loose Screws

Over years of troubleshooting odd problems in ham-band equipment from various manufacturers, I'm still amazed at how many problems can often be solved by simply checking the tightness of the little Phillips-head screws that hold down the various individual boards in these radios. The equipment manufacturers will often use the mounting screws as pressure ground connections at the edges—or even sometimes in the middle—of a circuit board. If the board happens to have RF circuitry on it that requires a short, direct chassis ground connection, the loss of even one screw-hole pressure ground point can cause some very strange—often intermittent—problems to develop. Problems that defy most of the normal troubleshooting techniques.

I've sometimes failed to check this point myself, or a board may be hidden somewhere out of sight behind a wiring harness, and I've ended up spending many wasted hours of tracing down dead-ends, when all that I really needed to do was to make sure that those little mounting screws were snug.

Since quite often soldering flux from the factory wave-soldering machine will be deposited over the grounding pads on the foil side of these boards, there can often be times when it pays big dividends just to loosen the screws slightly, then retighten them, hopefully breaking any insulating barrier. It may not even be a total insulating barrier, just a high-resistance ground connection, but where RF is concerned, even a higher than normal resistance ground will often cause unpredictable and frustrating problems.

At times, I've had to actually clean the grounding pads with a flux remover to restore proper pressure ground connection on some PC boards. Acetone and lacquer thinner will also work, but be sure to observe the exposure precautions on the labels. The use of toothed lockwashers under the mounting screws in critical areas is also sometimes advisable, just make sure that you don't lose any of the lockwashers "somewhere in the works" when removing the screws at a later date. You can indicate which screws have lockwashers under them by a small "star" drawn next to the screw with a permanent, sharp, felt-marker pen.

So next time you experience some inexplicable problem in your radio, try the screw-tightening routine first. Good solid board-grounds are especially important in ham mobile equipment to protect against internal grounding problems due to both vibration and to the drastically changing temperature and humidity conditions often found inside of the mobile environment.

That's all for this month, but we'll be back next time with more tips, techniques, and suggestions in Ham To Ham. Don't forget to send in your ideas to the address shown above and we'll publish half-a-dozen or so of the better ones in this column each month, plus send you ten of Uncle Sam's greenbacks for your time and trouble!

73 de Dave NZ9E

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of *73 Magazine,* and thus no guarantee of operational success is implied. Always use your own best judgement before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or *73 Magazine* for any equipment damage or malfunction resulting from information supplied in this column.

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NEVER SAY DIE

Continued from page 4

Don't forget what happened to the Branch Davidians when they came up against the Feds. Or Wilhelm Reich, who was thrown in prison by the FDA, where he mysteriously died. Or putting Royal Rife in prison for curing cancer, and destroying all of his amazing microscopes.

We have the makings of a pretty good country, but mass apathy and ignorance are allowing Congress and the Feds to make a real mess of things. There are plenty of books exposing what the IRS, FDA, ED, FBI, CIA, and other government agencies have been doing. We're just seeing the tips of the icebergs in the evening news.

Now let's see what you can do in designing a simple blood purifier circuit.

AIDS-Schmades

For most hams AIDS is either a very remote or a non-worry. Our homosexual brethren and sisteren probably are more interested. I'm concerned because I hate to see people dying unnecessarily early, even though it helps save our so-called Social Security system from an early collapse. That's why I've been writing about other health demoters such as fat, cigarettes, booze, and other such slow poisons.

Yes, I've been reading again. There's another book by Dr. William Douglass (*Second Opinion Newsletter*). This is on AIDS and he confirms some ridiculous rumors I've heard, but dismissed as the usual paranoia from Chicken Littles.

Douglass points out that AIDS started simultaneously in several African states, Haiti, and Brazil. Now, by a very curious coincidence, these are the same places where the World Health Organization (WHO) launched smallpox vaccine campaigns. Further, Douglass shows that the virus could not have come from animals (or a monkey), but had to have been designed and engineered for humans. In the 1972 Federation Proceedings, WHO suggested that a neat way to test immunity-suppression systems would be to introduce them via a vaccination program. Douglass says the epidemic didn't come from a monkey, it came from the labs at Fort Detrick, Maryland.

If AIDS had started, as claimed, from one monkey bite, the most cases that could be expected to have developed from that would be about 8,000, and not millions of infected people. Well, this certainly is one way to clear out a lot of Africans. And homosexuals, if that was the plan.

In New York, the head of the city blood bank set up a hepatitis vaccine study which curiously targeted males between 20 and 40 who were not monogamous. It now appears that 100% of those participating were infected with the AIDS virus. But heck, you can read the report for yourself: *Second Opinion*, 800-728-2288, $9.

In the meanwhile I've read several books by doctors claiming to cure AIDS using UV light, oxygen, herbs, and so on, and I have yet to hear from or about anyone who has failed to recover after using the simple and inexpensive blood purifier.

Slow Poison

There's a growing backlash against politically correct writing. Calling prisons "correctional institutions" is stupid. Prisons don't correct. They aren't designed or organized to correct. They're for punishment. Ditto our so-called Defense Department. It used to be the War Department, but that was back when mental hospitals were called insane asylums.

Which brings me to health care. Har-de-har. Few (if any) people will spend ten cents or spend a minute to be healthy, so there's little money in it. But when people get seriously sick, they'll spend everything they've got or can borrow to get over being sick. So, that's where the money is. Big money.

Our "health care" industry is run by doctors who haven't a clue about how to stay healthy. They're trained to look at symptoms, diagnose, and then use chemicals or knives to alleviate the symptoms, not the causes. Our medical schools don't teach health or sickness avoidance, except the use of vaccines.

One result of all this, plus the normal "I'm going to live forever" attitude, which is particularly strong with teenagers, but doesn't fade away much with age . . . at least until a big enough sickness arrives to force a reconsideration of mortality . . . is our ability to live comfortably while dosing ourselves with a whole range of slow poisons. Like what? Cigarettes, alcohol, polluted air, chlorine and fluorine in our water, magnetic radiation, negative dispositions, dental amalgam fillings, root canals, aspartame in our drinks, "recreational drugs," uppers, downers, Prozac, a Whopper & fries, even sugar . . . stuff like that. They're all slow poisons.

No, the magnetic field (EMF) radiation you get sitting next to your final amplifier isn't going to kill you soon. Neither is smoking one pack of cigarettes or snorting one line of coke. One can of Diet Coke is unlikely to kill you. Nor one Big Mac.

Yes, I'm aiming right at the heart of American culture. World culture, really. Well, how many people in their 50s do you know who are in robust health and look 20 years younger? And how many have heart disease, arthritis, bad backs, cancer, Alzheimer's, ulcers, Parkinson's, a great big fat constipated gut hanging out over their belt, emphysema, or are grossly overweight, and so on? The evidence is overwhelming that these, and virtually every other sickness, comes from our slowly poisoning ourselves.

Yes, I know about germs. You want to know more about germs? Well, do some reading. Find out what Royal Rife (*The Cancer Cure That Worked,* Barry Lynes, 1987, 168p, $16, ISBN 0-919951-30-9, Marcus Books, Box 327, Queensville, Ontario, Can. L0G 1R0, 416-478-2201), Gaston Naessens (see later), Antoine Béchamp (*Pasteur Exposed,* Ethel Hume, 1923–1989, 260p, $22, Bookreal, 8 Millar St., Denmark, WA 6333, Australia), discovered about them. In the meanwhile, consider that even in the worst of epidemics, there are some people who don't get sick. It has to do with our immune systems.

The end result of our slowly poisoning ourselves is that when I go to a reunion of my old WWII submarine crew, more than half have already died, and the rest don't look all that good. I did see a few healthy-looking old timers at Dayton, but not many. More obvious were the 11-months pregnant old men. What ever happened to that old-fashioned concept of an ounce of prevention?

If you're in your 30s, are you aiming at death in 20, 30, 40, or 70 years? Choose your poisons. There are little groups of people here and there around the world who are living healthily into their 100s. Yes, of course scientists have discovered their "secret," but I'll bet you've never read about these discoveries.

If you can stop from slowly poisoning yourself, you'll have a better chance at inflicting your crazy ideas on your great grandchildren. Your immune system starts out strong, but it eventually gets poisoned so badly that you are wide open to any bug that comes along, or it can trigger a genetic weakness. Your calcium-phosphorous ratio may swing one way or the other, depositing calcium where it hurts, or leaching it out of your bones.

In The Beginning

The human body, despite what you may believe from the Bible, has slowly developed over millions of years. It was developed to work in conjunction with the environment. I hope that makes sense. Now, think about what the environment was a hundred thousand, a million, five million years ago. Man ate food, drank water, and was exposed to sunlight. Until just a few thousand years ago man ate raw food, like all other animals. A French doctor got the totally crazy idea that maybe eating cooked food was causing some of our health problems. After all, it takes more than a few thousand years for our bodies to adapt to a major change in food like that.

So he first tested this outrageous theory on animals. What do you know, those fed raw food were healthy. Those fed cooked food got human ailments. Not being overly dumb, he then tried this radical approach to health on some dying patients. He got them to stop eating French cuisine and eat only raw food. Meat, fish, veggies, fruits, nuts. You got it, even those patients who were next to death's door started getting better. Cancer, AIDS, acne, tennis elbow, and so on. When I read about that it was almost enough to make me think. But let's not let this startling information get out. We don't want to destroy the great American food industry, right?

What would happen if everyone started eating raw food? General Mills would be demoted to Private. Battle Creek would be demoted to Skirmish Brook. We could probably close down 90% of our hospitals and senior rest homes, move the retirement age up to 92, and so on. It'll never happen. We see ever more kids starting to smoke, building a lifetime addiction to a deadly poison. Ditto beer. No, until the accumulated poisons of decades knocks people down, they'll live for today and ignore the future.

That's the way my father lived, smoking Camels for years. But he spent the last 20 years of his life (after he'd stopped smoking) suffering from emphysema. The last couple of years he had less than 10% of his lungs still working and had to have an oxygen bottle at hand 24-hours a day.

Sure, he knew how bad cigarettes are. Even when he was young they called 'em coffin nails.

As for me, I'm shopping mostly in the organic food section of the supermarket. I load up on fruits and veggies. I do enjoy dipping veggies in some curried yogurt. Nuts, with the salt rinsed off, and raisins make a great snack. I'm fortunate to live on a farm and thus have good well water so I don't need to buy a purifier to get rid of the chlorine and fluorine most city water supplies provide. But I do add extra minerals to my water in the form of colloids. And I get out there every morning, getting those UVs into my eyes and jogging a couple miles up and down the New Hampshire hills. We have no air pollution up here. So, unless Nabisco puts out a contract on me for upsetting their poison apple cart, I may be a persistent nuisance until our hobby is folded up and our frequencies sold to the highest commercial bidder.

Like our poisoning ourselves, we'll probably lose our bands slowly, starting with the microwaves. We're not using 'em anyway, so what's the difference, right? That was the attitude toward the top two MHz of two meters in the 50s and 60s. That's when the chaps at *CQ* tried to get 146–148 MHz turned into a new CB band. Thanks, guys. And, as long as the core ARRL membership of old white men have 75m and 20m, we're not likely to hear more than a tiny peep out of the League.

Good Reading

One of the benefits of my getting away from the office and out to give talks or attend scientific conferences is the opportunity to catch up on my reading. I read in the car while Sherry drives. I read in airport lounges, while flying, and in hotel rooms in the evenings.

There are three outstanding books that I've read recently. First, there's *Maximize Immunity,* by Bruno Comby (1994, 265p, ISBN 0-9819951-11-2, Marcus Books. This is the French doctor who discovered the amazing ability of the immune system to rebuild itself, even after years of poisoning . . . by switching to raw food. This is a must read. The subtitle is, "Unleash your body's best defense against illness."

Another very exciting book is *Secrets of the Soil* by Chris Bird (1989, 444p, ISBN 0-06-091968-X, Harper & Row, $15). This book covers so many things I could write a 16-page booklet just discussing the many topics. Like using music to make plants grow, the destructive use of pesticides and chemicals on our farms and how to avoid insect destruction to organic farms. The magic of magnetized water. It's a thick book and it'll have you wearing out your highlighter. That's probably a better use of $15 than a subscription to *Radio Fun,* but barely.

Then there's *Young Again,* by John Thomas, (1994, 384p, ISBN 1-884757-75-8, Plexus Press, Box 827, Kelso WA 98626-0072, 206-423-3168, $20). The subtitle is, "A personal guide to ageless living—How to reverse the aging process." Sounds good, eh? Well, it sounds good when you look around and half of your peers are Silent Keys and the rest are doddering on their last legs. About the only place I feel young these days is when I give a talk to a ham club and find I'm the youngest one there.

If you want to find out more about germs and how a Canadian doctor discovered how to beat the auto-immune system, making it so you'll eventually be able to avoid organ rejection after you've poisoned an organ to death and have to replace it with a borrowed one, you want to get a copy of *The Persecution and Trial of Gaston Naessens* by Chris Bird, (1991, 320p, ISBN 0-915811-30-8, H.J. Kramer, Box 1082, Tiburon CA 94920, 415-435-5367, $13). You'll also read the extent to which the Canadian medical system and the government went to stop Naessens from curing cancers.

The "health" business is just that, a business. It's all about money. When I approach AIDS workers with the news that I have a simple, inexpensive way to tackle AIDS they get all upset. AIDS is incurable, they shriek at me. Well, there are millions of dollars flowing through the medical system dependent on just that. And what would happen to the National Cancer Institute if it were known that there are some simple, inexpensive cures? I don't know which work best, or even if at all, but I have read several books recently which strongly suggest that there are some successful approaches which do not depend on chemotherapy, which has a success rate around 5%.

If I had cancer I'd run, not walk, to find out more about essi-

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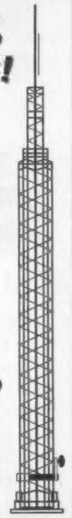

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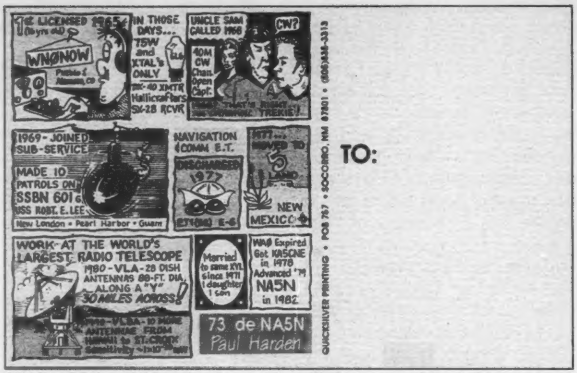
ac, the Canadian herbal remedy. You might want to look for Richard Thomas' *The Essiac Report,* 100p plus around 150 pages of testimonials, ISBN 0-9639818-0-3, ATIN, 1244 Ozeta Terrace, Los Angeles CA 90069, 310-278-6611, $20. I'd also get in touch with some of the medical groups working with Dr. Naessens' 714-X, as explained in the book. And what would it hurt to read Dr. Hulda Clark's book, *The Cure for All Cancers,* 1993, 511p, ISBN 0-9636328-2-5, $20, ProMotion Publishing, 10387 Friars Road #231, San Diego CA 92120, 800-231-1776. This is the book I saw featured in the window of the book store in the Edmonton (Alberta) research hospital. But then, it's your life to do with as you wish, so you can depend on your good old doctor if you want. But I'll bet he doesn't know squat about any of the alternatives to drugs, chemotherapy, and surgery.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The Cabal

Unless the many people I've met in the alternative medicine field are all suffering from paranoid delusions, which I doubt, there is a nasty collaboration between the AMA, the FDA, the pharmaceutical companies, and the insurance industry to maintain the status quo. Well, it's a trillion-dollar industry, so I can understand why everyone involved would be resistant to change. Any low-cost cure for a dread illness would cut revenues for everyone.

Now, if Comby is right about a totally raw food diet being able to strengthen the immune system enough so it can fight off illnesses of all kinds, and the word starts getting out, think what that could do to the whole medical industry! Oh, we'd still need a few doctors and hospitals for knife and gunshot wounds, as well as car accidents, and other emergencies. But most of the drug companies would go out of business, as well as the big food companies. So, if you think the current campaign by the electric companies to poo-poo EMF dangers is impressive, wait'll you see the number of doctors the health care and food industries can line up to warn against the dangers of eating raw food. Hey, pass me another carrot . . . they're pretty good, even without salt.

The usual serendipity brought in a copy of the Marion Dow newsletter, *CardiSense,* which had a feature article on food, pointing out that until very recently man (and woman) has eaten meat, fish, vegetables and fruits. No milk or bread products. No alcohol. And these early societies did not have "civilization diseases" such as cancer, heart disease, stroke, diabetes, and high blood pressure. You know, all those things you have.

It also pointed out that while chicken can be good food, you want to buy only free ranging chickens and not the fat-bloated chickens, doped with hormones, antibiotics, and tranquilizers, you see piled high on most supermarket counters. And steer (pardon) clear of beef, which has been specially bred to kill you with extra fat. Thank heavens for a handful of fanatics who have been pioneering organically grown foods. Wait'll you read that *Secrets of the Soil!*

All you have to do is stand near a supermarket checkout counter and watch the people going by and what they are buying to see why they look the way they do. And why you look the way you do, too.

Had Your Heart Attack Yet?

You'd better read *Left For Dead* by Dick Quinn, 1992, 200p, ISBN 0-9632839-0-1, $13, Quinn Publishing, Box 17100, Minneapolis MN 55417, 800-283-3998. Dick had his heart attack and had the usual by-pass surgery. But it didn't help him, so his doctor wanted to do a few more. Then Dick found out about cayenne pepper and cured himself and everyone he could talk to. You should read his book. If you do, you'll be looking around for cayenne pepper too. Hey, it only burns twice.

It wouldn't hurt to look for a good book or two on chelation. I was suspicious of it at first, but the more I've read, the more it looks like a good approach to getting your arteries cleaned out. Check out *Forty Something Forever,* by Harold & Arline Brecher, subtitled "A consumer's guide to chelation therapy and other heartsavers." 1992, 377p, ISBN 0927839-46-6, $7, Healthsavers Press, Box 683, Herndon VA 22070, 703-471-4734.

And if you think I'm exaggerating about the medical establishment fighting anything new or different, you want to read, *Racketeering In Medicine,* by Dr. James Carter, 1992, 363p, ISBN 1-878901-32-X, $13, Hampton Roads Publishing, 891 Norfolk Square, Norfolk VA 23502, 804-459-2453. Read about how the medical establishment, hand-in-hand with the FDA, has done a job on acupuncture, nutrition, chelation, chiropractic, homeopathy, osteopathy, etc.

Anyway, I highly recommend you read Dick's book before you have your heart attack and a series of mostly useless by-passes.

Real Research Needed

I don't know which of the endless nostrums I get promotions about in the mail are worthwhile and which aren't. But I also haven't seen any sign that our medical establishment is making any effort to check them out.

Oh, I can understand. The worst nightmare for the National Cancer Institute would be a cancer cure. And what would happen to the $200 billion pharmaceutical industry if raw food really does prevent almost all illnesses, and we're somehow able to convince people to eat it? So, when I read about doctors having success with alternative approaches, complete with endless testimonials from people who were at death's

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door, I want to know more, and cut the self-serving baloney.

How efficacious are chlorella, saw palmetto, echinacea, kombacha, ginger, garlic, cayenne, hydrogen peroxide, chromium picolinate, silver colloids, ginkgo biloba, ginseng, gero vita, and so on? The National Institute of Health (NIH) has set up a department to check out these and all the other nostrums, but I haven't seen any sign of action yet.

If you find any books you think I should read, please let me know. And I'll keep passing along the titles of those I've found which have impressed me the most favorably.

Chef Green

Now that I've shifted to a largely raw food diet after reading the Comby book, I've been digging up some of my family's old recipes. This is a simple one for cole slaw that's the best you ever tasted. I've had a lot of cole slaw shoved at me in restaurants, but none has ever come close to my grandmother's old recipe. Give it a try, it's a beaut.

First shred some raw cabbage. Maybe a quarter of a cabbage. Be careful of your fingers. I took a thin slice off the ends of two of mine the first time I shredded. Mix 2T olive oil, 2T apple cider vinegar, 1T sugar, 1/2t salt, 1/8t pepper, 1/2t celery seeds, 2T mayonnaise, 6T sour cream. Whip it all together and mix into the shredded cabbage. T = tablespoon; t = teaspoon, but you knew that.

Maybe you'd better make a double batch. It won't last long. And yes, you can use reduced fat mayonnaise and sour cream. I do. Or even yogurt. This also makes a great dip for raw veggies.

QSL Contest Resuscitated

Good grief, you should see some of the crappy QSL cards I've been getting. Remember, you only have one chance to make a good second impression. Your first opportunity was in how interesting you made the contact for the other chap. Did you get him to talk about himself at length? And about more than his rig, antenna, and the weather? Your second chance is your QSL. How distinctive and interesting is it? Is it one he'll put up where visitors can see? Will he show it around? Well, why the heck not? Oh, you're too lazy to think, is that it? There goes Wayne, asking you to think! Just take a look at the story on the back of NA5N's card. Now there's a card you'll show around! Paul did the artwork himself. And if you get one of my cards I guarantee you'll be showing it to everyone. If I get one of yours, what'll I do? Flip it into the box with a thousand others?

You are an individual, despite your teenage efforts to be like everyone else, so get to thinking about how you are different and see if you can build that into your card. Even my business card is different. Heck, I know you're not going to believe this, but I used very small type and put a sort of mini-biography on my card. No one forgets it, and it provides lots of interesting conversations. No, I didn't list everything I'm interested in, that would take a book. Just the biggies like cold fusion, hamming, scuba diving, skiing, gourmet cooking, and stuff like that.

Now get out a pencil and paper and start designing a QSL card that will let me know about *you*. If you can't draw any better than I, then find a friend who can and get him to do your artwork. Make me remember your card.

And when you have a winner, send it in to the *73* QSL Contest and see if you can win. Or at least get honorable mention. Winners get an extra year of *73* and the runners up will win their choice of one of my fabulous CDs.

Aspen Ham Conference

If you ski, and if there's enough snow, could I get you and your wife to take off a few days in early January to get together with me in Aspen for some skiing, ham talk, and general conversation? I'm ready to both pontificate and listen on alternative health, solving our many social problems, religion, ham radio's future, cold fusion developments, cosmology, skin diving, and so on. It's a ball to ski down the slopes of Buttermilk/Tiehack, Aspen Highlands, and Snowmass, with interesting people to talk with on the lifts and over lunch on top of a mountain. I'm a good intermediate skier, so I can probably keep up with you. And we can rap at any of the fabulous Aspen restaurants over dinner.

The rich and famous may be all over the place, but it really doesn't cost a lot to stay there, and over 70 you ski free. Heh, heh. I've been going there since I first learned to ski in 1966, when I was in my 40s.

So let's get some adventure into your life. I'm planning on being there January 4–11th, which is the economy season, right after the holidays, when there are usually short (if any) lift lines and wide open slopes. ■

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HOMING IN

Radio Direction Finding

Joe Moell P.E. K0OV
P.O. Box 2508
Fullerton, CA 92633

Cooperative Tracking and Web Surfing

"No Clues!" That's the admonition you'll hear if you transmit any useful information during a southern California hidden transmitter hunt. During these mobile radio direction finding (RDF) contests, which are usually called T-hunts or foxhunts, the hunters in each vehicle compete against all the others. Each team wants to be first to find the signal source, or to find it with low mileage, depending on the rules.

Long-time T-hunters never forget that they are in a contest. When they encounter their opponents along the way, they aren't above committing some friendly prevarication or spreading disinformation to throw them off the trail. "Never trust another T-hunter" is a maxim heard often. It's all in good fun, of course.

One Big Team

Sometimes, the rivalry has to be put aside. When a jammer or stuck carrier makes your repeater useless, or when a station in distress must be located, it's important to know how to perform cooperative RDF. T-hunting can teach that, too. In years past, one of the most popular scheduled southern California hunts was sponsored by the Mount Wilson Repeater Association (MWRA). When the hidden station appeared on the repeater input, base stations and T-hunting mobiles throughout the repeater's wide coverage area began to report their bearings and signal-strength indications for all to hear. Some base stations used computer programs to triangulate all the bearings and deduce the most likely coordinates of the hider. The mobiles would zoom down the freeways to that location and close in.

With several mountain ranges and urban areas within the hunt boundaries, the bearings seldom agreed fully and the triangulation was hardly ever perfect; however, it was great fun and excellent practice for emergency RDF. Two winners were declared for each MWRA hunt: the mobile team that first found the T, and the mobile or base station that reported the most accurate initial bearing. Hiders faced a special challenge. Whereas on most clubs' hunts it is only necessary for the transmissions to fool hunters at a single starting point, this event demanded a deceptive signal all over the repeater's coverage area.

April (WA6OPS) and I have stumped the MWRA hunters, but only once. We put a very low power transmitter on the side of a high hill that faced the repeater. With a long beam, we achieved a full-quieting signal into the repeater, but the mobiles couldn't hear it at all and the base stations couldn't hear it well enough to get good bearings, thanks to the hill behind the T. We egged them on by talking to them via a remote 2 meter station on a different mountain, dozens of miles away. They could hear this remote on the repeater input, of course, but it was a diversion, not an aid. After about four hours, they all gave up.

MWRA hunts have not been held for several years, but cooperative hunting is alive and well elsewhere. The Snohomish County RACES T-hunters tried it on 2 meter simplex in the mountains of western Washington state this summer. RACES RDF coordinator Jim Bowman W7HPK reports that they planned ahead to make these hunts effective practice for rapid wilderness rescues.

The first hunt was in June, when the T turned out to be close to a narrow mountain logging road with deep ruts and thick brush overhanging both sides. At the beginning, the seven teams split into two main groups, one starting out east and the other going west. Eventually one team went up the foreboding road, found the T, and everyone gathered for a picnic.

A month later it was Jim's turn to hide. The lessons learned a month before led to better organization and preparedness. This time, the seven teams were assigned tactical designators such as Blue Team and White Team. By using these tactical calls (as well as ham calls at FCC-required intervals), it was easier for teams to keep track of one another, no matter which team member was at the mike. Detailed ranger district maps were provided for all. Teams attempted to keep in touch with one another on 440 MHz FM simplex. Knowing that this band can be difficult in the mountains, some teams had 75 meter sideband as a backup.

"Charles Scharlau NZ0I volunteered to serve as the Resource Station," Jim reported. "He tried to find a good stationary location from which to monitor the progress of the hunt and to keep track of where the teams were, what roads had been checked out, and what bearings had been taken and from where. Then he would inform the various teams as appropriate."

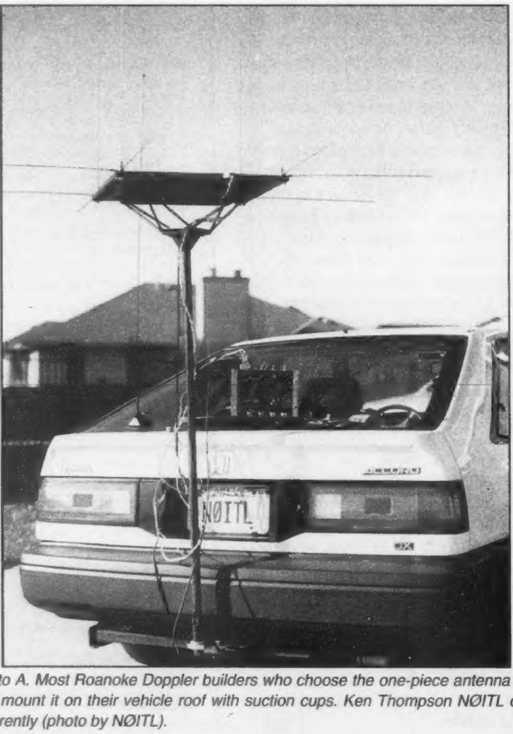

Photo A. Most Roanoke Doppler builders who choose the one-piece antenna system mount it on their vehicle roof with suction cups. Ken Thompson N0ITL did it differently (photo by N0ITL).

Unfortunately, NZ0I's preselected location was based on a bad guess. It turned out to be 12 miles and several mountain peaks away from the hiders, making communications difficult as they closed in. Despite this problem and the momentary terror when one vehicle's brakes failed on a steep narrow road, Jim reported that everyone enjoyed themselves and cooperative hunts will continue in the future.

Let Mother Nature Hide

Compared to Snohomish County, the T-hunt policy around Wichita, Kansas could best be described as "partial cooperation." Ken Thompson N0ITL reports that T-hunters there are regularly called upon to recover equipment from high-altitude amateur television (ATV) balloon launches.

Nowadays, most high-dollar ham balloon payloads incorporate a Global Positioning System (GPS) receiver to report its exact location throughout the flight. If that feature works, RDF isn't needed for recovery after the balloon bursts and the package drops to earth. "I developed software that takes the GPS information from the balloon and from my car, then combines the data streams on one serial port," Ken says. "It will plot my path, the path of the balloon, and the distance and bearing to the balloon from the car. It keeps track of everything in real time."

Since a sensitive GPS receiver might not survive the shock, temperature, and altitude extremes of a flight into the stratosphere and back, Wichita ATV balloon enthusiasts include a backup 2 meter beacon in the payload. According to N0ITL, "At the heart of it is a crystal oscillator for a computer video card at 29 MHz. The output is processed to peak the fifth harmonic, which goes to a wire antenna. A lithium battery provides power and a PIC microcontroller provides CW identification."

Just for fun and to practice for wayward balloons, Ken and his T-hunting friends like to put up these little beacons without the rest of the ATV equipment. "Every couple of months we get itching to do it," he says. "We put the transmitter and battery in styrofoam insulation and launch it under a six-foot helium party balloon that costs five dollars at the local card store. The whole payload is about the size of two fists. On the ground, you can hear it maybe half a mile away. Up in the air, it can be heard for thirty miles or so. It probably achieves almost forty-thousand feet in altitude and stays up one and a half to two hours. We had one travel about fifty miles and land in the middle of the Flint Hills. It's cattle country, where there's a barbed-wire fence about every three miles and no roads.

"With no parachute, it generally takes about fifteen minutes to crash after the balloon bursts," N0ITL continues. "We can tell when the signal goes on and off and flutters that it's coming down, and we have only about a quarter hour to get within a mile of it or we'll lose it. At that point, it turns into kind of a free-for-all hunt. We talk to each other on 440, telling what town we're in and what direction we're hearing it from. I'm proud to say I'm usually first on the scene, which has to do partially with my Doppler and also with my ability to interpret its display well. But I also drive pretty fast."

N0ITL prefers his Roanoke Doppler RDF set over the beam-and-S-meter method for this kind of hunting. His mounting system for the four-whip Doppler antenna is unique (see Photo A). "I wanted to preserve the finish on my car," he told me. "A three-quarter-inch bolt is welded to a heavy gas pipe for the mast. It goes up to a four-by-four-inch plate with eight quarter-inch rods welded to a ring of angle iron that the plywood base bolts to. There are clear plastic three-eighths-inch beads on all the vertical and radial elements for eye protection. The system is solid, but it comes apart in two pieces for storage. I remove the glass mount whip antenna in the rear window when hunting so that it won't affect the bearings."

N0ITL says that the preparation and practicing of Wichita T-hunters paid off this summer when thunderstorm warnings activated hams for possible tornado spotting. "Suddenly, we had a stuck transmitter to find. A carrier with white noise was on our RACES repeater input. It was stronger over here on the east side of town, so all the guys with Dopplers took off. We ended up in the next county about 30 miles east. A ham was using a dual-band mobile unit as a base station in his house. While he was out storm spotting for his county, something happened and the radio locked on in the crossband repeater mode. It took us about a half hour, but we drove right to it."

Worth Browsing For

As a general rule, I've found that T-hunters like learning, building, and experimenting with new technologies. It's no surprise, therefore, that most are computer literate and a high percentage seem to be on packet and the Internet. Personal E-mail and the "fox-list" mailing list have alerted me to much of the T-hunting news in this column for the past few months. So it's no surprise that World Wide Web sites for RDF enthusiasts are starting to appear.

The biggest and best Web source of T-hunting information I have found so far is maintained by Brett Coningham AB5P. He lives in Albuquerque, New Mexico, a city second to none when it comes to enthusiasm for mobile transmitter-chasing contests (see Photo B). "I use an Internet service provider here in town," says Brett. "Storage for the page files is all provided and they have a UNIX Web server that does all the work, so it's really easy for me. I develop the pages at home, then I log in and copy the files directly onto a directory area on the system. The UNIX computer does the rest."

When you log on to Brett's home page, you'll find a directory of articles telling about the way T-hunting is done in Albuquerque, when the hunts are, and what equipment the hunters prefer there. Everything is written with a twinkle in the eye and a tongue in the cheek. If you're like me, you'll laugh out loud when you read about the plusses and minuses of "Binford Beams," which were named after the famous testosterone-laden "Tool Time" products on ABC-TV's "Home Improvement."

Click to another page and you'll find "T-hunt Bloopers," with a half-dozen tales (as of this writing) of hides and hunts gone awry. One of my favorites is about the mobile RDFers who got their coax cables mixed up in the middle of a hunt and accidentally connected two VHF radios together instead of to their respective antennas. There are also stories of legendary hiding feats such as the rotating beam hunt of Kevin Kelly N6QAB (see Photo C).

"Having the site has been fun," says AB5P. "I've gotten a lot of E-mail about it. I had 2500 log-ins last month, from at least a couple dozen countries. I plan to add more pages as time goes by. I want to scan in some photos of our hunts so people can get a better idea of what it looks like."

A visit to Brett's home page made me glad I went through the trials and tribulations of getting my Web browser software installed and working. (It wasn't easy.) By the way, no parental control is necessary, because AB5P's pages are all G-rated, and the G stands for "giggles."

Photo B. Weekend transmitter hunts in Albuquerque attract good attendance. They start at 9 AM on the first Saturday and third Sunday of each month in a parking lot on the University of New Mexico campus.

Lost in Cyberspace

I've read that in spite of its reputation, the US Postal Service is still more reliable than E-mail for getting messages through. I didn't believe it until a couple of weeks ago, when my E-mail volume dropped to 10% of normal. The next day, there was even less, then it stopped completely. It took me eight days to find the technician at America Online who could solve the service's technical problem and re-establish my incoming mail. (Thanks, Kenny!) Meanwhile, readers who sent E-mail to me got no "Message Undeliverable" replies to tell them that their letters weren't getting through.

Many of my incoming messages were later recovered, but about 140 were lost during that time. So if you sent E-mail to me in late August expecting a reply and you didn't get one, please try again. I still think E-mail is more convenient than postal mail, but I'm not ready to pay my bills via Internet yet.

Resources in This Article

Plans for the Roanoke Doppler RDF set used by Wichita hunters can be found in "Transmitter Hunting—Radio Direction Finding Simplified," by Joe Moell K0OV and Tom Curlee WB6UZZ. This 323-page reference book (TAB/McGraw-Hill #2701) covers all aspects of RDF and is available from Uncle Wayne's Bookstore. Antenna system improvements are in "Homing In" for April and June 1995.

The URL address for AB5P's T-hunt World Wide Web site is @internet:http://swcp.com/~ab5p/foxhunt.html.

To subscribe to fox-list, the worldwide Internet T-hunt mailing list of the Boston Amateur Radio Club, send a one-line E-mail message to listserv@netcom.com with the text "subscribe fox-list" (without quote marks). The subject line is ignored. You will begin to receive all messages addressed to the list and you will get E-mail explaining how to post and unsubscribe. Note that there is a hyphen in "fox-list," but not in "listserv."

K0OV's E-mail address is HomingIn@aol.com. CompuServe users can send mail to 75236.2165

SIMP. 146.565
I'D RATHE
T-HUNT
SUZUKI
HUNTCAM EQUIPPED
N6QAB
AMATEUR RADIO OPERATOR
NEW MEXICO
Photo C. Kevin Kelly N6QAB lived in Albuquerque only a short time, but he helped T-hunting become a regular activity there. His unusual hiding tricks, such as the "rotating beam hunt," are legendary.

Number 25 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the April issue, we should receive it by January 31. Provide a clear, concise summary of the essential details about your Special Event.

NOV 4

GODFREY, ILL The Lewis & Clark Radio Club will host the Midwest Amateur Radio Expo 8 AM-2 PM at the Riverbend Arena, Lewis and Clark Comm. College. VE Exams, pre-reg. by calling *Richard Morgan, (618) 466-2306*. For general info, call *Harold Elmore, (618) 466-1909*. For Flea Market spaces, tables, contact *Larry Roberts, (618) 466-0041*.

ENID, OK The Enid Hamfest Group will sponsor a Hamfest 8 AM-5 PM at Garfield Co. Fairgrounds, Oxford and 4th Sts. Talk-in on 147.375(+), and 444.825(+). VE Exams at 1 PM. Covered Dish Banquet at 7 PM. Contact *Tom Worth N5LWT, days or eves, at (405) 233-84733;* or write to him at *2302 Eucalyptus Ave., Enid OK 73701*. Internet e-mail *EnidARC @aol.com - ATTN: TOM*. This event is listed under HAMFEST *.

EUSTIS, FL The 1995 Lake County Hamfest and Electronics Expo will be hosted by the Lake ARA, 9 AM-5 PM at Lake County Fairgrounds. W5YI VE Exams start at 11:30 AM, walk-ins welcome. ATV and Packet demos. Talk-in on 147.255 or 442.900. Contact *Tony Summerlin KE4NLG, (904) 787-1449*. Make checks payable to *L.A.R.A.* and send with SASE to *L.A.R.A., c/o Tim Morrison, P.O. Box 881, Tavares FL 32778*. Last mail out will be Oct. 15th.

LAKE WORTH, FL The West Palm Beach ARC will present a Free Flea in John Prince Park, 8 AM-2 PM. Talk-in on 147.135(+) or 146.670(-). Contact *Marvin Kaskawits KD2CK@KB4VOL at (407) 683-2930;* or *p001471b @pbfreenet.seflin.lib.fl.us*.

NOV 5

KAUKAUNA, WI The Fox Cities ARC Hamfest will be held at the Starlite Club on the corner of 55 and JJ. Doors open at 8 AM. Talk-in on 146.76 pl 100. For info, write *FCARC, 2410 E. Newberry Ct., Appleton WI 54915;* or call *Dan Vanevenhoven, (414) 739-5101*.

NOV 11

MONTGOMERY, AL The Montgomery ARC will host the 18th annual Montgomery Hamfest/Computer Show in Garrett Coliseum at the South Alabama State Fairgrounds on Federal Drive. Flea Market setup 3 PM to 8 PM Fri., Nov. 10th; and 6 AM-8 AM Sat., Nov. 11th. Doors open 8 AM-3 PM CST. VE Exams on-site starting at 8 AM. Bring original and a copy of your current license, picture ID, and $3. Talk-in on 146.24/.84, call W4AP. Ragchew on 146.32/.92, with phone patch, *up/#down), 147.78/.18, 449.50/444.50. Please reserve Flea Market spaces early; call (after 5 PM), *Steve, (334) 270-0536; FAX (334) 264-1150;* or write to *Hamfest Tables, c/o 2736 W. Aberdeen Dr., Montgomery AL 36116*. Special Hamfest rates at *Statehouse Inn, 1-800-552-7099*. For more info, write to *Hamfest Committee, c/o 2141 Edinburgh Dr., Montgomery AL 36116-1313;* or phone *Phil* at *(334) 272-7980;* or *FAX (334) 264-1150.*

MYRTLE BEACH, SC The Grand Strand ARC will present a Hamfest, 9 AM-4 PM, at Myrtle Beach H.S., Central Dr., between 29th and 38th Aves. N. VE Exams at Noon; call *Les Shattuck, (803) 236-3036*. Talk-in on 145.11. For reservations, contact *David C. Berry KE4DOW, Grand Strand ARC, P.O. Box 2135, Myrtle Beach SC 29578-2135. Tel. (803) 248-9401.*

NOV 12

BRANFORD, CT The SouthCentral Conn. ARA will hold its 16th annual Flea Market at the Branford Intermediate School, 185 Damascus Rd. Sellers 7 AM, Buyers 9 AM. Talk-in on 146.01/.61. VE Exams, reservations no later than Nov. 1st. None by phone. Info or reservations, SASE to *SCARA, P.O. Box 705, Branford CT 06405-0705.* For info, call *Brad, (203) 265-9983, 24 hrs.*

CARTHAGE, MO The Carthage ARS will sponsor a Hamfest, 8 AM-1 PM, at Memorial Hall, Garrison and Oak Sts. Setup 5 AM-8 AM. Talk-in on 147.42 MHz simplex. Contact *Jim Dixon WX0J at (417) 358-2761;* or write *P.O. Box 783, Carthage MO 64836.*

NOV 18-19

FORT WAYNE, IN The Fort Wayne Hamfest and Computer Expo/1995 Indiana ARRL State Convention, will be held at Allen County War Memorial Coliseum Expo Center Sat., 9 AM-4 PM EST; Sun., 9 AM-3 PM, EST. Setup is Fri. eve. and Sat. morning. VE Exams. Forums. Ladies Events. Presentations by Gordon West WB6NOA. Shuttle bus service provided. For more info, contact *John Rufner KB9BNI, (219) 483-6305 (tables)*; or *Don Gagnon WB8HQS, (219) 484-3317 (info)*. Or, write to *ACARTS, P.O. Box 10342, Fort Wayne IN 46851.* Sponsor: Allen County AR Technical Soc., Inc.

TAMPA, FL The 20th annual Suncoast Amateur Radio/Computer Convention will be held by the Florida Gulf Coast AR Council, at Florida Expo Park, Expo Hall. For more info, call *(813) 525-5178*, or write *Jean Endicott, 1556 56th Ave. North, St. Petersburg FL 33703.*

NOV 19

BENSON, NC The Johnston ARS., Inc. JARSFEST95 will be held 8 AM-4 PM at the Americal Legion Complex on Hwy. 301 N. For info, contact *Bill Lambert AK4H, 8917 Hwy. 50 N., Benson NC 27504. Tel. (919) 894-3352 eves. 7 PM-10 PM*. Talk-in on 147.270(+). VE Exams begin 10 AM sharp, courtesy of RARS VE Team. Pre-reg. until Nov. 13th. Send completed Form 610, photocopy of your current license (if applicable), indicate the highest class of license you desire to be tested for; and send a check or m.o. for $5.90 payable to *JARS*, to *Vince Yakamavich AA4MY, 220 Carriage Trail, Raleigh NC 27614. Tel. (919) 847-8512* for exam info. To reserve space, call *(919) 894-3352, 894-3100, and 894-5479, 7 PM-10 PM.*

NOV 19-20

TAMPA, FL The Suncoast Amateur Radio/Computer Convention will be held by the Florida Gulf Coast ARC at Florida Expo Park Expo Hall, starting Sat. at 7 AM. Expo hall opens 9 AM. CW Contest at 12 Noon. NTS Traffic Forum at 1 PM. There will also be an ARRL Forum and ARES Forum. Gate opens at 7 AM on Sun., Expo Hall opens at 9 AM. Activities include Basic Packet by Paul Evans, APRS demo, Hidden Transmitter Hunt, Antenna building workshop, and more. For more details, contact *Jean Endicott, 1556 56th Ave. North, St. Petersburg FL 33703. Tel. (813) 525-5178.*

NOV 25

EVANSVILLE, IN The 3rd annual E.A.R.S. Evansville Winter Hamfest will be held 8 AM-2 PM, Central Time, at Vanderburgh County Fairgrounds (US 41, at Boonville-New Harmeny Rd.—between I-64 and Evansville). Setup begins at 6 AM. Talk-in on EARS Rptr. Net, 145.150(-) Evansville; 146.925(-) Vincennes. Alternate: EARS Rptr. 145.110(-). For reservations or info, contact *Neil WB9VPG, (812) 479-5741*, or write *EARS, 1506 S. Parker Dr., Evansville IN 47714.*

SPECIAL EVENT STATIONS

NOV 4-5

MUSKEGON, MI The Muskegon Area ARC will operate W8ZHO 1800Z Nov. 4th-1200Z Nov. 5th, from aboard the USS Silversides. General 40-20m, phone, and CW. For a certificate, write to *Robert Carter WB8OQT, P.O. Box 691, Muskegon MI 49443.*

NOV 6-7

ELLENVILLE, NY Amateur radio operators from the Science Teachers Assn. of NY State, will operate KB2JDB 1400Z-2200Z Nov. 6th and 7th, to demonstrate amateur radio to science teachers, and commemorate the 100th Anniversary of the organization. Operation will be in the General and Novice portions of the 80 to 10 meter subbands. For a certificate, send QSL and an SASE to *Jim Kuhl N2SPK, Central Square Middle School, 1150 US Rt 11, Central Square NY 13036.*

NOV 6-9

GUELPH, ONT. CANADA Between Nov. 6th and Nov. 9th, the Guelph ARC will operate VG3W from the McCrae House Museum, to commemorate the 80th Anniversary of Col. John McCrae's writing of the WW1 poem "In Flanders Fields." This is also the 50th Anniversary of the liberation of Europe in WWII. Nov. 11th is called Rememberance Day, or Poppy Day in Canada. VG3W will operate on all bands from 1500Z-2200Z. QSL via *VE3ZM, Guelph ARC, P.O. Box 1305, Guelph Ontario, Canada N1H 6H9*. Please send Canadian postage, 1 IRC, or one Green Stamp.

NOV 11-12

BELLEVILLE, NJ The Irvington-Roseland AC will operate K2GQ, 1400Z-2100Z to commemorate the club's 50th Anniversary. Operation will be in the General portion of the 80m-15m bands, the Novice portion of the 10m band, and on 146.52 FM. For a certificate, send QSL and SASE, or 1 Green Stamp, to *Bill Fitzsimmons N2LMU, 102 Cedar Hill Ave., Belleville NJ 07109.*

FORT KNOX, KY The Lincoln Trail ARC will operate the 3rd annual Veteran's Day SE Station, KR4CW, from the Army MARS station, to commemorate those who have served our country. The Station will operate in the Novice 10 meter and the General area of 15, 40, and 80 meters, SSB and CW. Send QSL and SASE to *LTARC, P.O. Box 342, Vine Grove KY 40175*, to receive an 8 1/2" x 11" color certificate.

NOV 18

JACKSONVILLE, NC Get a certificate for working a club station in Turkey (NC). For the club's annual observance of Thanksgiving, the Onslow ARC will operate WD4FVO from the grounds of the Cabin Museum just outside of Turkey NC. OARC's "Turkey Talk" is a day long field event. The club will operate both HF and VHF stations on CW, SSB, and packet, 9 AM-4 PM EST. Listen in the Novice and General CW and voice portions of HF bands 80-10 meters. Send the club an SASE for a certificate suitable for framing. Contact *Onslo ARC, P.O. Box 841, Jacksonville NC 28541-0841.*

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BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, *73 Magazine,* 70 Rt. 202N, Peterborough NH 03458, and get set for the phone calls.

The deadline for the December 1995 classified ad section is October 12, 1995.

ALL ABOUT CRYSTAL SETS. Theory and construction of crystal set radios. $9.95 each, ppd USA. Send to: **ALLABOUT BOOKS,** Dept. S, P.O. Box 22366, San Diego CA 92192. BNB200

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RCI-2950/2970: New modification manual including Power increase. Clarifier modification. Modulation increase. Operating hints, and more. Parts included. Only $20.00 ppd in U.S. (Missouri residents add $1.15 tax). **SCOTT,** P.O. Box 510408, St., Louis MO 63151-0408. (314)846-0252. Money Orders or C.O.D. BNB340

HR2510, RCI2950, CONNEX 3300, COBRA 148, GALAXY SATURN, plus many more kits to increase your modulation, $19.95. **(800)536-0109.** BNB350

NI-CD BATTERY analyzer cycler. PC controlled. DOS software. $289 PO Box 672, London, Ontario Canada N6A 4Y4 **Lamantia Products** 519-472-5566 Fax 519-472-1702 BNB385

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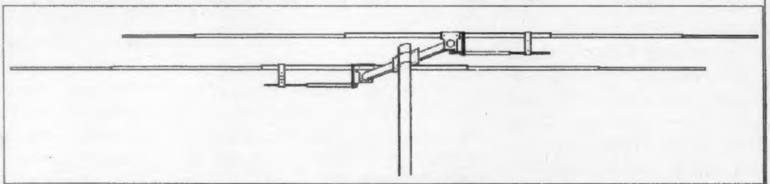

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Conditions This Month

Cycle 22 continues to amaze . . . and while the sunspot numbers continue to decline, the solar flux level refuses to follow along, and has remained rather steady since spring. The solar minimum is still likely to occur sometime during 1996, in my opinion, but the flux remains quite stubborn. I think that "conditions," therefore, ought to remain just a bit better than expected for the next few months.

The *worst* days for propagation (and perhaps other geophysical conditions) are likely to occur in late October and continue until the middle of the second week of this month. The chart shows VP (Very Poor) for the 1st and the 4th, and P (Poor) for the 2nd, 3rd, and 5th, followed by gradual improvement for the remainder of the month. The best days (G) should be the 9th through the 12th, 16th through the 19th, and 26th through the 30th. The remaining days in between will trend from Good to Fair or vice versa.

10 and 12 Meter Bands

Not expected to be very good, but still should be monitored for transequatorial/tropical paths during the daylight hours.

15 and 17 Meter Bands

Similar in overall outlook to 10 and 12 Meters, but with better chances to work DX because of the outright popularity of these bands throughout our worldwide community.

20 Meter Bands

This is your workhorse band for worldwide DX during the daylight hours this month, with occasional openings beyond local time sunset, moving from east to west, and long skip north and south.

40 Meter Bands

DX on this band should be available from just before sunset until just after sunrise, which also means broadcast station interference in the phone portion of the band. Concentrate on the days marked fair or even poor, as conditions on the higher bands (which should still be checked) may make them unusable.

80 and 160 Meter Bands

Expect some fairly good DX and short-skip openings during the hours of darkness, which will lengthen the time we will be able to pursue our pastime!

VLF (1601–90 kHz.)

Anyone with interesting happenings in this portion of the spectrum is invited to contact me. I'd like to receive data regarding conditions over a period of time—that is, fair, improving to very good over a period of days, and vice versa, with signal levels, distances worked, time of day, etc.

Please let me know how these forecasts are working for you. See you next month. Jim W1XU.

NOVEMBER 1995

SUN	MON	TUE	WED	THU	FRI	SAT
			1 V-P	2 P	3 P	4 VP
5 P	6 P-F	7 F	8 F-G	9 G	10 G	11 G
12 G	13 G-F	14 F	15 F-G	16 G	17 G	18 G
19 G	20 G-F	21 F	22 F-G	23 G-F	24 F	25 F-G
26 G	27 G	28 G	29 G	30 G		

KEY

VG .... Very Good
G .... Good
F .... Fair
P .... Poor
VP .... Very Poor

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U.S.S.R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R								20	20			

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U.S.S.R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

AN INVITATION FOR YOU TO JOIN THE GREEN TEAM

73, *Radio Fun*, and *"Cold Fusion"* magazines are actively recruiting more members for the lean, mean, Wayne Green team here in Peterborough. Translation: Wayne's hiring experienced and/or trainee employees.

Career opportunities abound for **MAC literate people** who know how to use Microsoft Word, Quark Xpress, and Adobe Photoshop, **create technical drawings**, **edit manuscripts**, etc. There's a need for **circulation management** and **advertising sales** people too. Translation: **Help wanted**.

What skills do you have to offer? If you are a non-smoker and in the southern NH area, please contact Frances Hyvarinen at 603-924-0058 or FAX 603-924-8613 for an interview or send detailed résumé which includes your work experiences, future ambitions, and phone number to Green Team, 73 Magazine, 70 Rte. 202 N, Peterborough, NH 03458.

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Letters

Continued from page 6

megahertz of the former 2-meter ham band?" I can just hear it!

We in Indiana are not experiencing the problems (to the extent described) that the ARRL is suggesting.

I'm not saying that there are *no* problems associated with the job of frequency coordination, and I am certainly understanding that some states might need enforcement help. But why are you going to let the ARRL get involved in your job? There are other alternatives, such as calling on other state Frequency Coordinators, talking to other hams, talking to your wife, and maybe calling a priest, but don't rely on the ARRL to do the right thing for you! It probably won't happen. They (the ARRL) are too mired in the politics of the federal government lobby, the FCC, and the apparently intoxicating effects of being that close to power over the masses (that's you, fellow ham operator!). They've got too much money, and it just gets down to this: they probably just don't give a damn what you (or I) think anyway. I would hope that in my lifetime, my attitude towards them (the ARRL) would change for the better, but I don't know if I'll live that long!

We (the Indiana Repeater Council) have just had a "changing-of-the-guard" in the executive staff. They are thoughtful, intelligent, and committed to the task of frequency coordination and all that it entails. We're working on a new set of band-plan proposals utilizing 15 kHz spacing (for the most part) that will allow many more frequencies to be properly coordinated in the 29, 50, 144, 222, and 440 bands. That is, if the membership and the adjacent states want to adopt them. The plans also include very viable suggestions for where to put those dual-band, cross-band repeating-transceivers into operation for the best results and the least congestion and interference. After that, we're going to tackle the job of suggesting new plans for the 900- and 1200-MHz bands that favor utilization of more modern modes of transmission, such as CDMA, TDMA, T-1, and the like. Our mindset is that of trying to move amateur radio relay techniques forward to the point where we should be already . . . in the leadership position, not the slackers' corner! The executive board of the IRC has also endorsed a new set of technical transmitter adjustment suggestions for repeaters, auxiliary stations, and users. We have a fine crew to handle the job of frequency coordination in the State of Indiana. Please note that we (the IRC) know our place . . . we are not a dictatorial organization . . . we are in the business of making *suggestions* and offering help. We are *recognized* by the local and regional ham-radio population, and that is where we draw our strengths and maintain our identity. We do *not* need further laws, and rules, and regulations, and financial support burdens to be more legitimate. We're doing just fine out here in the cornfields of Indiana, thank you! We believe in a simple idea, "if it ain't broke, don't fix it!"

If you would like us to share our ideas with you, just ask! Our address is:

Indiana Repeater Council, c/o Cass Co. ARC, P.O. Box 1092, Logansport, IN 46947.

73, Jim KK9T. ■

NEW PRODUCTS

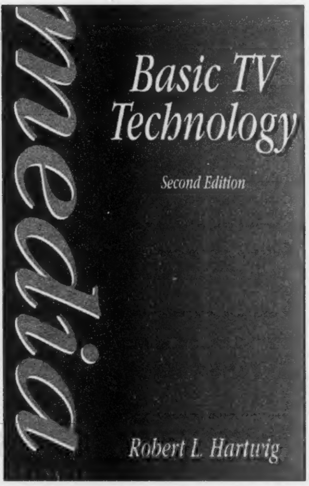
Compiled by Wayne Green W2NSD/1

RF Industries

RF Industries has just released its RFA-4027 SMA Technician's Adapter Kit, which fits the 13 most popular SMA adapters and contains both in-series and between-series adapters, satisfying most adapter requirements. They're housed in a zippered leatherette case which lies flat when fully opened. All adapter sections are nickel-plated, machined brass with gold-plated contacts in Teflon dielectric. For more information, contact: *RF Industries, 7610 Miramar Rd., San Diego, CA 92126-4202; (619) 549-6340, (800) 233-1728, fax: (619) 549-6345.* Or circle Reader Service No. 201.

Octavia—Box 88 Opened

The whole Russian callbook, including all the previous Soviet Republics, is now available on two 3.5" floppies for your PC (no Mac). There are more than 50,000 hams and their addresses listed, many with their home phone numbers. You can update the list, even add notes when you make a contact. The list is updated twice a year (April and October). It's available for $25, plus $3 shipping by air (money orders, no checks) from *Jan Bexner SM7DEW, Villa Dalen Berghem, S-34191 Ljungby, Sweden.* Or circle Reader Service No. 202.



Basic TV Technology

Focal Press has a new 172p $20 paperback edition (2nd) which will help you understand how TV works. It starts out with the most basic of fundamentals, with the end result that you'll finally have a good grasp of the subject. Alas, there's no index (tsk!), and it doesn't go into compression technology like MPEG.

Circle Reader Service No. 203.

Gordon West Advanced Book Now Updated

Amateur radio operators wishing to upgrade to Advanced class may now obtain the new, updated Advanced class FCC license preparation book, written by well-known instructor, Gordon West WB6NOA. The new book covers all 582 Element 4A questions and answers, with four possible answers and West's unique explanation for every question.

The first 20 pages are devoted to bringing the licensed radio amateur up to date on recent changes within the amateur radio service. Chapter 3 specifically guides the radio amateur through testing procedures for the Advanced class exam. The book explains exactly what to bring to the VE test session. It also contains tear-out pages of formulas.

The book is available through leading amateur radio dealers and all Radio Shack stores, with a new blue and green cover and a photo of author. The book is $11.95, and is published by Master Publishing, Inc. Or circle Reader Service No. 204.

Communication Technology Update, 4th Edition.

Despite the possibly daunting title, this is a book that every red-blooded (and blue-blooded, and even lily-livered) ham should read. No equations. No complex circuits. No build-it-yourself projects. This book is packed solid with the latest hot scoop on what's doing in radio, TV, video, digital, and so on technology. It's all in relatively plain English, except for the welter of acronyms.

So what's MPEG2+? The next time this comes up during a QSO, you'll know the answer. What ever happened to MD and DCC, which your Uncle Wayne predicted in his *CD Review* editorials would fail as new music formats? Sony and Philips wasted hundreds of millions on these. Read all about it.

This 428-page 8" x 11" book is an interesting read, covering digital video compression, cable TV, Video Dialtone, interactive TV, direct broadcasting satellites, high definition TV, low power TV, radio broadcasting, computer technology, the Internet, electronic messaging, on-line services, multimedia, video games, desktop publishing, fax machines, virtual reality, desktop video production, camcorders, digital audio, satellites, distance learning, local and long distance telephones, fiber optics, integrated services digital network, cellular telephones, videoconferencing, and videophones. Nope, it doesn't mention amateur radio, forsooth.

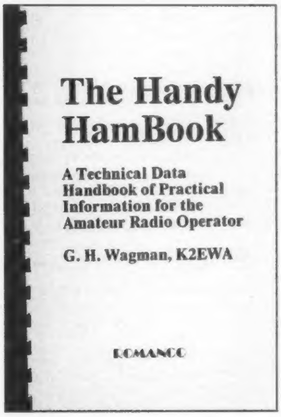
By the time you're through reading this you'll have a good solid general education is current communications technology. Also, if you have even a shred of creativity left after semi-surviving our fabled American school system, you'll see endless opportunities for applying these new technologies to amateur radio. How many QSOs could we cram onto the 20m phone band using compressed digital audio signals instead of SSB? A hundred times as many? With less QRM? If they can cram a VHS-quality video signal on a telephone wire, we ought to be able to put one on 20m. Who will be the first to transmit "Steamboat Willy"2 on 20m?

Each of the chapters I listed above were written by experts in their fields. And, despite the Ph.D.s on many of their names, they've managed to make their material easily understandable.

About the only negative is the lack of an index. Tsk!

Oh yes, how much? $37. ISBN: 0-240-80238-1. Focal Press. Buy it. Circle Reader Service No. 205.

Handy HamBook


The Handy HamBook
A Technical Data Handbook of Practical Information for the Amateur Radio Operator
G. H. Wagman, K2EWA
ROMANCO

This is a great little book, packed full of tables, charts, and data you need around the ham shack. Coax info, country lists, antenna formulas, Q-signals, PL-tones, ASCII characters, over 200 pages of essential information that you don't want to have to hunt for when you need it. It's been gathered by Gerald Wagman K2EWA. It's published by *Romanco Enterprises, Box 34, Milltown NJ 08850.* The book is $14.50 postpaid, unless you're in NJ, in which case there's 72¢ tax. Or, better yet, move to NH and save the 72¢. Circle Reader Service No. 206.

Kantronics

Version 6.0 of Kantronics KPC-3 is now GPS-compatible. The TNC connects to GPS receivers with NMEA-0183 interfaces and make it so users can use as many as four GPS unit's NMEA data strings; GPS data can be stored for later retrieval and is accessible via the KPC-3's mailbox; users can specify beacon start time and amount of time between beacons, so multiple stations can report without a collision; the system operator can reconfigure the GPS unit from a remote location; and it's APRS compatible. Kantronics has an EPROM upgrade available for earlier versions.

Contact: *Kantronics, 1202 E 23rd Street, Lawrence KS 66046 (Fax 913-842-2021) for more information.* Or circle Reader Service No. 207.

Uncle Wayne's Bookshelf

REFERENCE

RS-1 **The Amateur Radio Mail Order Catalog and Resource Directory, 4th Edition** is the most comprehensive source book for electronic parts, software, and equipment targeted at the radio amateur or serious electronic hobbyist anywhere! Plus a wealth of "value-added" reference material all in 262 pages. 4th Edition clearance at only **$8.95**. (was $16.00)

TAB2701 **Transmitter Hunting** *by Joseph Moell and Thomas Curlee* Radio direction finding simplified. **$19.95**

UE202 **RTTY Today** *by Dave Ingram* Modern guide to amateur radioteletype. **$8.95**

TP002 **The World Ham Net Directory** *by Mike Witkowski* New—2nd edition. Introduces the special interest ham radio networks and shows you when and where you can tune them in. **$9.50**

WGP87158 **1995 North American Callbook** The 1995 North American Callbook lists the calls, names, and address information for 500,000+ licensed radio amateurs in all countries of North America. **$35.00**

MMH24 **Radio Handbook, 23rd Ed**. *by William I. Orr W6SAI* 840 pages of everything you wanted to know about radio communication. **$39.95**

WGP1234 **1995 International Callbook** The new 1995 International Callbook lists 500,000+ licensed radio amateurs in the countries outside North America. It covers South America, Europe, Africa, Asia, and the Pacific area (exclusive of Hawaii and the U.S. possessions). **$35.00**

AR4092 **Your RTTY/AMTOR Companion** invites you to explore the world of HF digital communications. If you've never operated RTTY or AMTOR before, this book is written expecially for you! You won't find complicated technical jargon here. Just information you can use right away. You'll discover how to . . . Assemble your own RTTY/AMTOR station . . . Use RTTY and AMTOR to talk to amateurs throughout the world . . . Compete in RTTY/AMTOR contests . . . Hunt for digital DX. **$8.00**

AR3754 **Radio Frequency Interference—How to find it and fix it.** Interference problems are challenging, but curable. With the techniques in this book, you can help restore electronic peace in your neighborhood. **$15.00**

DOV41 **Basic Electronics** *Prepared by the Bureau of Naval Personnel* Covers the important aspects of applied electronics and electronics communications. **$12.95**

DOV76 **Second Level Basic Electronics** *Prepared by the Bureau of Naval Personnel* Sequel to Basic Electronics, thorough treatment of the more advanced levels of applied electronics. **$9.95**

20N096 **How To Read Schematics (4th Ed.)** *by Donald E. Herrington* Written for the beginner in electronics, but it also contains information valuable to the hobbyist and engineering technician. **$19.95**

WLSWOCP **Radio Operator's World Atlas** *by Walt Stinson, WOCP* This is a compact (5x7), detailed, and comprehensive world atlas designed to be a constant desk top companion for radio operators. **$17.95**

TAB37109 **Secrets of RF Circuit Design** *by Joseph J. Carr* Written in clear nontechnical language, covers everything from antennas to transistors. **$21.95**

TAB11065-1 **Mastering Radio Frequency Circuits** by Joe Carr, 411 p. If you're interested in learning about radio components and circuits, this book is great! Plus there are a ton of simple circuits you can build. It explains how circuits work, about test equipment, receivers, the works. This will take a lot of the mystery out of how radios work . . . the easy way. This will be one of your better $20 ham investments. **$20.00**

DP919 **73 Magazine Index 1960-1990** A complete index to every article published in *73 Magazine* through 1990. IBM software **$20.00**

NEW BOOKS

AR4920 **Introduction to Radio Frequency Design** In this practical book, the author emphasizes use of models and their application to both linear and nonlinear circuits, reviews traditional material stressing the viewpoints taken by the RF designer and illustrates subject material by numerical examples. Includes 3 1/2 inch disk for IBM PC or compatibles. **$30.00**

R&D57450 **Raptures of the Deep** *by Fred Jueneman* What we understand in science today, and the challenges facing scientists in just about every field. An incredible job of research on how and why scientists believe what they do about our world and how it works. **$29.95**

GEI3579 **Final Quantum Revelations** Dr. Kiril Chukanov uses not only science but revelation to answer difficult and profound questions about physical reality and cosmic destiny. **$34.95**

TEC7787 **Exploring the Physics of the Unknown Universe** *by Milo Wolff* Packed with intriguing discussions like, What is the origin of the laws of physics? and What is the nature of space? A simple and readable book on how mathematics describes the physical universe and what paradoxes and enigmas remain for an enterprising mind to solve, with speculations on the nature of subatomic particles as standing interference patterns of spherical waves. **$39.00**

SHORTWAVE

NBPAW94P **1995 Passport to World Band Radio** *by International Broadcasting Services, Ltd* You'll get the latest station and time grids. **$19.95**

07R25 **The RTTY Listener** *by Fred Osterman* New and expanded. This specialized book compiles issues 1 through 25 of the *RTTY Listener Newsletter*. Contains up-to-date, hard-to-find information on advanced RTTY and FAX monitoring techniques and frequencies. **$19.95**

09S42 **The Scanner Listener's Handbook** *by Edward Soomre N2BFF* Get the most out of your scanner radio. **$14.95**

CRBSM1 **Scanner Modification Handbook, Vol. 1** *by Bill Creek* provides straightforward step-by-step instructions for expanding the operating capabilities of VHF scanners. **$17.95**

CRBSM2 **Scanner Modification Handbook Vol. 2** *by Bill Creek* Here it is—a companion to Vol. I. In fact, Vol. 2 has a section that provides improved approaches and updated techniques for the mods in Vol. 1. There's 18 new exciting modifications for popular scanners. **$17.95**

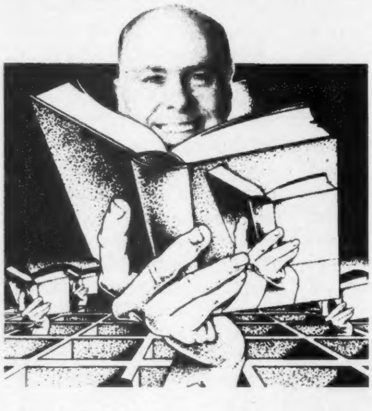
TAB 339643 **Tuning In To RF Scanning** From Police to Satellite Bands. Bob Kay. 150p 1994, Tab Books. This is a wonderful book for the VHF-UHF scanner listener. It explains about the various radio bands, antennas, the laws, and lists frequencies for every imaginable service . . . including the Secret Service, FBI, military, IRS, prisons, Fish & Wildlife, McDonald's order windows, nuclear search teams, railroads, Russian satellites, Treasury Dept., wireless microphones for concerts, and so on. **$14.95.**

07A66 **Aeronautical Communications Handbook** *by Robert E. Evans* Exhaustive, scholarly treatment of shortwave aeronautical listening. **$19.95**

AR4025 Beyond Line of Sight. Shows how hams pushed forward the discovery of the propagation modes that make VHF DX possible: tropo, sporadic-E, aurora and auroral-E, meteor scatter, F-Layer propagation, transequatorial propagation and earth-moon-earth. **$12.00**

TAB 447748 **The Shortwave Listener's Q&A Book**—Everything you need to know to enjoy Shortwave Listening. Choosing receivers, accessories, antennas, frequencies, and getting QSLs. SWL is an exciting hobby . . . that's what got me interested in hamming . . . Wayne. **$12.95**

WAYNE'S PICKS



WG1H **LEARN THE CODE** There are two ways to learn the code, (1) the easy way, (2) everyone else's way. Your choice. There are two speeds of code you need to know — one (5 wpm) you can learn in less than an hour, the other (20 wpm) takes longer, but nowhere near as long as you probably think. Sure, you can also learn it at 13 wpm, if you want, but that just wastes your time.

Learning to copy code is just like learning to type or play the piano, if you have to stop and think, you can't do it. It has to be made automatic, so if you go the usual code training route of starting slow and speeding up you are screwing up. That brings you to that dreaded plateau at about 10 wpm, where you've reached the brain's clock speed. Then you have to start all over from scratch and do it the way you should have in the first place. With Uncle Wayne's tape you start right out at 20 wpm and train your hand to write what your ears hear.

Uncle Wayne gives you a choice on the 5 wpm code test. You can either buy the El Zippo one hour method of passing the test, which is enormously over-priced at $5, or you can buy two tapes . . . one, The Genesis, takes about an hour to teach you the code characters ($5.95 — 73T05) and the other, The Stickler ($5.95 — 73T06) gives you an hour of fiendishly difficult practice at 6 wpm. Then there's the 13 wpm Back Breaker ($5.95 — 73T13), in case you for some masochistic reason want to bother learning the code at 13 per. And the ever popular Courageous 20 wpm tape ($5.95 — 73T20). If you find you've become a code fanatic, there's the 25 wpm Mind Boggler ($5.95 — 73T25) which will serve you right.

Until wiser herds . . . er, heads . . . are able to dump the code requirement from the ham exams, the El Zippo and Courageous are the least frustrating route to ham nirvana. And by the way, anyone can learn the code if they go about it Uncle Wayne's way.

WG2 **The Million Dollar Video** Explains how just about any company can increase sales by over a million dollars through the sneaky (aka intelligent) use of promotion. Explains in detail how you can get tons of free advertising. Uncle Wayne shows you how to beat the system. **$39.95**

"SEEK YOU" by The Ham Band—The titles include "Always on the air", "On the Monday Evening Grayline", "Radio Widow", "The Trip to Dayton", "The Contest" and seven more. Ham radio CD includes experiences that radio hams go through. This is an extremely entertaining CD and will strike a chord with any radio ham, SWL or XYL—an ideal present! **SYCD $15 SYTAPE $10.**

IB8657 **Dumbing Us Down: The Hidden Curriculum Of Compulsory Schooling.** *by John Gatto* If you enjoyed "Declare War", you'll enjoy this also. A Wayne Green recommended reading. **$9.95.**

SOFTWARE

GGTE Morse Tutor From beginner to Extra Class. Code from 1 to over 100 words per minute. Standard or Farnsworth mode. Create your own drills. Exams conform to FCC requirements. 5 1/4" floppy for IBM PC, XT, AT, PS/2 or compatibles.

GG52/5 Morse Tutor 5.25" Disk	**$19.50**
GG31/2 Morse Tutor 3.5" Disk	**$19.50**
GGADV5 Gold Edition 5.25" Disk	**$29.95**
GGADV3 Gold Edition 3.5" Disk	**$29.95**

W5GWHO **Ham Operator Education Package Software**. Novice—Extra for PC's, contains both 3 1/2" and 5 1/4" disks. **$39.95**

W5GWNSW **No-Code Ham Radio Software Package for PC's,** contains both 3 1/2" and 5 1/4" disks. **$29.95**

Lanze Code Programs—(Available on 5 1/4" * disk.) Inexpensive complete study guide code programs for both the C64/128 Commodores and the IBM compatibles. Programs include updated FCC questions, formulas, schematic symbols, diagrams, and simulated (VE) sample test.

	IBM Part#	Commodore Part#	Price
Novice	LZIBM01	LZCOM01	**$14.95**
General	LZIBM03		**$14.95**
Extra	LZIBM05	LZCOM05	**$19.95**

* Add $2.00 for 3 1/2" Disk

LAST CHANCE ITEMS

ONLY A FEW LEFT

SAM22488 **IC User's Casebook** A 'must' for any hobbist's workshop, covers ideal operation amplifiers, inverting and noninverting followers, linear amplifiers, active filters, digital circuts and waveform generators and timers. **$12.95**

SAM48441 **178 IC Designs & Applications** A comprehensive collection of linear developments for electronic design and basic applications. **$12.95**

ARRL BOOKS

AR1995 **ARRL 1995 Handbook (71st Ed.)** Features: added DSP, improved treatment of Pi and Pi-L, all new all-digital-logic, plus lots more. **$30.00**

AR1086-4 **ARRL Operating Manual (4th Ed.)** Information on how to make the best use of your station, including: interfacing home computers, OSCAR, VHF-UHF. **$18.00**

AR3657 **QRP Notebook** *by Dave DeMaw W1FB* Presents construction projects for the QRP operator. **$10.00**

AR3207 **W1FB's Design Notebook** *by Dave DeMaw W1FB* Filled with simple practical projects that can be built using readily available components and common hand tools. **$10.00**

AR0402 **Solid State Design** Good, basic information, circuit designs and applications; descriptions of receivers, transmitters, power supplies, and test equipment. **$15.00**

AR4173 **Now You're Talking! All You Need To Get Your First Ham Radio License (2nd Edition)** A complete study guide for the Technician and Novice written exam. Practical information every beginner needs is written clearly and simply and in small doses. **$19.00**

AR4971 **ARRL Repeater Directory 1995-1996** 19,000+ listings with digipeaters, bandplans, CTCSS (PL(TM)) tone chart, frequency coordinators, ARRL special service clubs, and beacon listings from 14 MHz to 24 GHz. **$7.00**

AR3398 **The DXCC Companion** *by Jim Kearman KR1S* Spells out in simple, straightforward terms what you need to be a successful DXer. **$8.00**

AR1250 **Log Book**—Spiral **$3.50**

AR3177 **The ARRL Spread Spectrum Source Book.** From a deceptively simple beginning, a group of experimenters set out to develop first theoretical and later practical systems for spread spectrum communications. This book consists of articles, papers and government reports that document the process whereby amateur spread spectrum progressed from the drawing board to the airwaves. **$20.00**

AR2960 **Transmission Line Transformers (2nd Ed.)** *by Dr. Jerry Sevick W2FMI* Practical designs and specific information on construction techniques and sources of material. **$20.00**

AR3851 **Hints and Kinks** Ideas for setting up your gear for comfortable, efficient operation. **$10.00**

ARRL License Manuals Complete FCC question pools with answers.

AR4181 **Technician Class**	$ 6.00
AR4688 **General Class**	$12.00
AR3274 **Advanced Class**	$ 8.00
AR3282 **Extra Class**	$ 8.00

AR3185 **The Satellite Experimenter's Handbook, (2nd Ed.)** *by Martin Davidoff K2UBC* Expanded and revised. Focusing on satellites built by and for the international radio amateur community. **$20.00**

AR2030 **Your Gateway to Packet Radio (2nd Ed.)** Tells everything you need to know about this popular new mode. **$12.00**

AR4645 **Satellite Anthology** The latest information on OSCARs 9 through 13 as well as the RS satellites, the use of digital modes, tracking antennas, RUDAK, microcomputer, and more! **$10.00**

AR4483 **Weather Satellite Handbook (4th Ed.)** *by Dr. Ralph Taggart WA8DQT* Expanded and revised to reflect today's weather-fax satellite technology. **$20.00**

AR4653 **Companion Software for Weather Satellite Handbook** 5 1/4" MS-DOS Floppy. **$10.00**

AR2083 **Complete DX'er (2nd Ed.)** *by Bob Locker W9KI* Learn how to hunt DX and obtain hard-to-get QSL cards. **$12.00**

AR3762 **Your QRP Operating Companion** No special rigs or expensive equipment to enjoy the excitement and challenge of low-power operating. **$6.00**

AR3169 **QRP Classics** Compilation of ARRL publications on building receivers, transmitters, transceivers, accessories. **$12.00**

AR4270 **FCC Rule Book** A must for every active radio amateur. **$9.00**

AR0356 **Morse Code: The Essential Language** *by L. Peter Carron, Jr. W3DKV* Expanded and revised in its 2nd edition. How to handle distress calls heard not only on the hambands but on maritime and aircraft frequencies. **$6.00**

AR3983 **Understanding Basic Electronics** An ARRL book. 314 big pages. This explains everything very simply: the math, DC, AC, transistors, even tubes (wow!). Dirt cheap at $17. Isn't it about time you understood the fundamentals? **$17.00**

ANTENNAS

AR4114 **Low Profile Amateur Radio** For the Ham who lives where antennas are frowned upon. From hiding your antenna to operating with low power. This books tells you how to get on the air using these tehniques, and others,without calling attention to yourself. **$8.00**

UE220 **The Easy Wire Antenna Handbook** *by Dave Ingram K4TWJ.* All of the needed dimensions for a full range of easy to build and erect "sky wires." **$9.95**

WGP87034 **All About Cubical Quad Antennas** *by William Orr and Stuart Cowan* "The Classic" on Quad design, theory, construction, operation. New feed and matching systems. New data. **$11.95**

TAB 3270P **Practical Antenna Handbook**—Second Edition, 1994, Joseph Carr; Tab Books. This 560-page book is a real treasure. Sarts with the fundamentals of antenna and feedline theory, explains about propagation of all kinds, and then provides a ton of easy antenna construction projects. Covers antennas and feeders for all bands. The explanations are simple and well illustrated, with some math, where it's unavoidable, but it won't bog you down. It even has the ZL-Special antenna, which I've used on 20m with some spectacular DXing success. A low angle of radiation and made it so I could always work the rare stuff first . . . Wayne. **$26.95.**

AR4734 **ARRL Antenna Book** The new 16th Edition represents the best and most highly regarded information on antenna fundamentals, transmission lines, design, and construction of wire antennas. **$30.00**

AR0194 **Antenna Compendium Vol. 1** Materials on verticals, quads, loops, yagis, reduced size antennas, baluns, Smith Charts, antenna polarization. **$10.00**

AR2545 **Antenna Compendium Vol. 2** Covers verticals, yagis, quads, multiband and broadband systems, antenna selection. **$12.00**

AR2626 **Companion Software for Antenna Compendium Vol. 2** 5 1/4" MS-DOS floppy. **$10.00**

AR4017 **Antenna Compendium Vol. 3** More verticals, yagis, quads, plus loops, arrays, mobile, direction finding, controlled currents, computerized, installation, overloads, plus 40 new articles for beginner's to advanced. **$14.00**

AR4661 **Antennas and Techniques for Low-Band DXing** can be your ticket to low-band success. Drawing on the experiences of successful DXers and the author's own considerable experience, John Devoldere, ON4UN. shares the tips and techniques that can make the difference between a station that takes part in a contest and one that wins it! **$20.00**

AR3819 **Physical Design of Yagi Antennas** *by David B. Leeson W6QHS* provides the tools here to design and build robust Yagi antennas, using sound mechanical engineering principles. You need no longer fear the consequences of wind or ice storms on your antennas. With this information, you can build or "beef up" existing Yagis. **$20.00**

AR2618 **W1FB's Antenna Notebook** *by Dave DeMaw W1FB* Get the best performance out of unobtrusive wire antennas and verticals. Build tuners and SWR bridges. **$10.00**

WGP87107 **All About Vertical Antennas***by William Orr* Comprehensive coverage of amateur communications. **$11.95**

WGP87042 **Beam Antenna Handbook** *by William Orr and Stuart Cowan* Everything you need to know about beam design, construction, and operation. **$11.95**

WGP87077 **Simple, Low-Cost Wire Antennas For Radio Amateurs** *by William Orr and Stuart Cowan* All New! Low-cost, multi-band antennas; inexpensive beams, "Invisible" antennas for hams in "tough" locations! New data. **$11.95**

AR2200 **Antenna Impedance Matching** *by Wilfred N. Caron* Most comprehensive book written on using Smith Charts in solving impedance matching problems. **$20.00**

AR0410 **Yagi Antenna Design** A *Ham Radio* series polished and expanded by Dr. Lawson. **$15.00**

AR2995 **Reflections** will help dispel the half-truths and outright myths that many believe are true about transmission lines, standing waves, antenna matching reflected power and antenna tuners. **$20.00**

AR3118 **Reflections**—Software for IBM 5-1/4" **$10.00**

UHF/VHF/PACKET

ARTSCI **U.S.Repeater Mapbook** *by Robert Martin* The Guide for traveling radio amateurs. **$9.95**

TP001 **The Basic Guide to VHF/UHF Ham Radio** *by Edward M. Noll* Provides a first rate introduction to the 2.6 and 1.25 meter bands as well as 23, 33, and 70cm. **$6.95**

AR3959 **Your Packet Companion** Perfect for the packet newcomer. **$8.00**

AR3878 **Your VHF Companion** Explore the fascinating activities on the VHF bands, FM and repeaters, packet, CW & SSB, Satellites, ATV, transmitter hunting and more. **$8.00**

03R02 **RTTY Today** *by Dave Ingram K4TWJ* Most comprehensive RTTY guide ever published. **$8.50**

BOOKS FOR BEGINNERS

TAB4354 **The Beginner's Handbook of Amateur Radio, Third Edition** *by Clay Laster W5ZPV,* 395 pages. Wonderful book for newcomers. It is basic and well illustrated. Even if you have all the other ham handbooks, you'll still find this one useful. **$22.00**

W5GWNV **No-Code Video, Manual, Part 97 Rules** Learn how to be a ham radio operator. **$29.95**

W5GWNC **Technician Class License Manual: New No-Code** *by Gordon West* This book covers everything you need to become a Technician Class Ham. Every question and answer on the examinations is found in this one book. FCC Form 610 application. **$9.95**

XTAL-1 The Crystal Set Handbook by Phil Anderson WØXI. Want to give a kid an exciting present? Or maybe yourself? Crystal sets are alive and fun. Here's a whole book packed with crystal set circuits that anyone can build. Now start saving those oatmeal boxes, okay? 133 pages **$10.95**

WAYNE WRITES

WG1 **We The People *Declare War* On Our Lousy Government**—360p soft cover. This is Wayne's report explaining what the major problems are facing both New Hampshire and the country, and proposing simple, inexpensive solutions: a simple way to have government departments happily cut their expenses by 50% within three years; how to cut the cost of incarcerating prisoners by over 90%; how to end welfare; how to reduce the deficit; how to cut medical costs and improve health care; how to cut school costs and improve schools. An absolute steal at **$13**.

WG4 **20/20 Foresight**—Twenty 16p updates on the **Declare War** book—320p. Further proposals for solving critical American problems, such as a new approach to financing small businesses, how to finance Russia and other countries and make a profit doing it, the real dope on bioelectromagnetics, a new kind of polytechnical university, a new electronics technology, why Africa is in such a mess, why Perot bombed, how to have tuition-free universities, a plan for making Congress turn honest, etc. Plenty more. Ridiculously priced at **$10**.

WG5 **Submarine Life in WWII**—60p. Wayne's story of his adventures on the USS Drum SS-228 on five war patrols in the Pacific in 1943-45. What's it really like on a submarine when you're being depth charged? And what's the day-to-day life on a submarine like? Did you see the movie Das Boot? Exciting stuff and only **$7.50**.

WG6 **Uncle Wayne's Caribbean Adventures**—96p. Wayne's adventures scuba diving all around the Caribbean, visiting ham operators, and sightseeing. If you're interested in how to travel economically, you'll get some great ideas from this. He starts out with his "Diving, the Wimp Sport." You'll love the visits to 11 islands in 21 days trip. A measily **$7.50**.

WG7 **Uncle Wayne's Travels**—52p. Wayne travels to Russia, London, Aspen, St. Pierre, Munich, Vienna, Krakow, and Prague without it costing nearly as much as you might think. Cheap for you too, at **$5.00**.

WG9 **Wayne Talks: 'Dayton' 1995**-90 minute tape-What he would have said if he'd been asked to speak. **$5.00**

CODE TAPES

73T05 **"Genesis" $5.95 5 wpm**—This beginning tape, takes you through the 26 letters, 10 numbers, and necessary punctuation, complete with practice every step of the way.

73T06 **"The Stickler" $5.95 6+ wpm**—This is the practice tape for those who survived the 5 wpm tape, and it's also the tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are set at 13 wpm and spaced at 5 wpm.

73T13 **"Back Breaker" $5.95 13+ wpm**—Code groups again, at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language code at only 13 per.

73T20 **"Courageous" $5.95 20+ wpm** Congratulations! Okay, the challenge of code is what's gotten you this far, so don't quit now. Go for the extra class license. We send the code faster than 20 per.

73T25 **"The Mind Boggler" $5.95 25+ wpm** Fiendishly generated by kindly old Uncle Wayne for hams with a strong need for self punishment. Once you've conquered 25 per let Unk know if you need a 50 wpm tape.

Uncle Wayne's Bookshelf Order Form

You may order by mail, telephone, or fax. All payments are to be in US funds. Allow 4 weeks for delivery. (Prices subject to change without notice if suppliers increase prices.)

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(Surface delivery may take 2 to 3 months.)

Note: The actual foreign shipping costs will be additional to regular shipping and handling fees.

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Have Beam, Will Travel!

Shake, twist—your walking stick becomes a beam!

How would you like a four element 2 meter yagi that travels the mountain trails as as walking stick? Pick a rest stop, remove the end cap, shake out the elements and feedline, and in two minutes your HT is full quieting wherever you point it.

Finished resting? Unscrew the elements and drop them into the boom; you're ready for travel. But whenever you get the urge, it's there, ready to zero in on a jammer, chase a radio fox, or shoot your signal out of a hole in time of difficulty.

What is it? ArrowBeam. It shoots straight and true, and its strong flexible elements are stored in the boom like arrows in a quiver. It weights only a pound and a half and is balanced in the hand, but it can take abuse.

Keep it in the trunk of the car. It's tough exterior protects everything against damage as it gets tossed and knocked about. But when it's time for action—shake, twist, and ArrowBeam is ready to shoot your RF right where you want it.

This handy versatile antenna is made to be dropped, bumped, and stepped on while you are racing through brush and branches in pursuit of the elusive radio fox. Drop it? It bounces. Snag a low limb as you drive by? Twang! the tempered elements just spring back into position. Sit on it? You'll need a bandaid for your fanny, but ArrowBeam will be ready for more.

Of course ArrowBeam will do just fine in an attic or on a mast even though it's made for the torture of the T-hunt.

Performance? ArrowBeam scored best for its boom length at the Dayton VHF competition. It's the antenna chosed by the FAA for its spook beacon and rogue ELT search teams.

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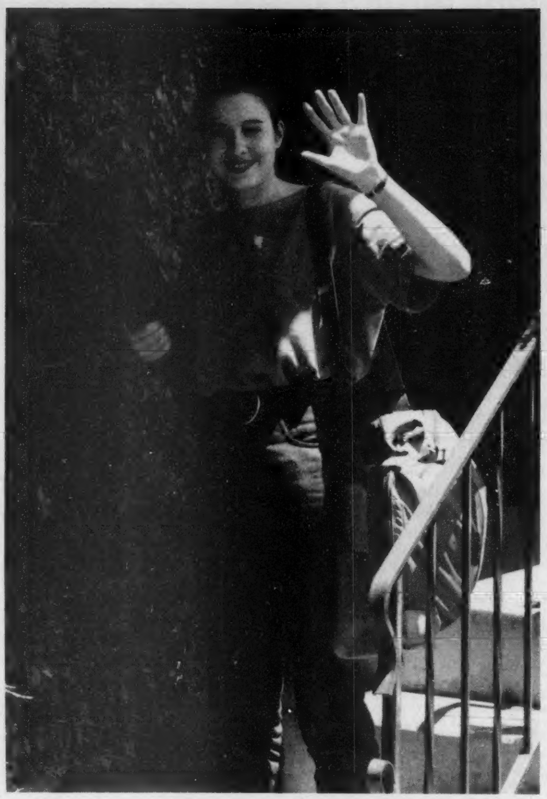

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You get the same great performance, the same ease of assembly, the same robust durability, but Grab-N-Go fits in your suitcase.

The Grab-N-Go ArrowBeam comes in its own forest green stuff sack. There's extra room there for other goodies you may wish to carry with your beam—feedline, homebrew PVC mast, omnidirectional Pico-J antenna, etc. This is the version Becca is taking on her trip.

ArrowBeams

- **Walking Stick 2m $79**
  Elements 4 Boom Length 48"
  Gain 6.1 dB Front/Back 10.1 dB
  SWR <1.1 min, <1.5 band edges
  Add $6 S&H
- **Grab-N-Go 2m $89**
  Same as above, but breaks down to <25" for storage. Mast mount and Forest Green Stuff Sack included. *Add $6 S&H*
- **Walking Stick 70cm $49**
  Elements 5 Boom Length 40"
  Gain 7.3 dB Front/Back 12.1 dB
  SWR <1.1 min,<1.5 band edges
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Other Range Extenders

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- 2m Packet Pico-J $22 ppd
- TigerTail (2m/70cm) $8 ppd

Save $5

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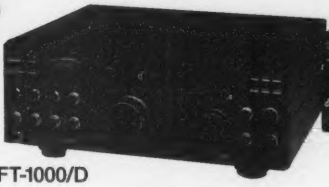
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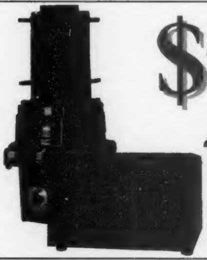

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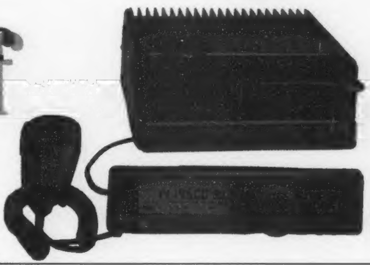
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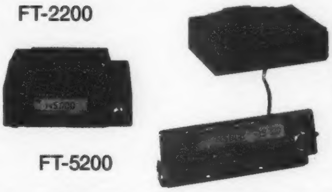
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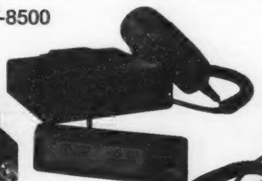
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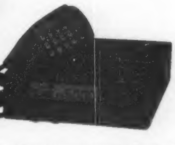
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